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ABSTRACT

The feasibility of classifying occupational tasks as a basis for understanding better the occupational transferability of job skills was examined. To show general skill relationships among occupations, 5 classification schemes were applied to 50 selected task statements for each of 12 occupations. Ratings by five reasonably knowledgeable people were obtained for the tasks of each occupation. A comparison of the task ratings was conducted to determine the skill components or aspects of tasks that would appear to be similar and could contribute to transfer capability among occupations. Additional exploration was attempted by obtaining overall job ratings, using each classification scheme, for a subsample of four of the occupations. This permitted an examination of the comparability of task-composition versus whole-job bases for identifying the skill components of an occupation. It was concluded that tasks can be individually classified, that at least some classification schemes produce reasonable rater agreement for a wide assortment of types of tasks, and that such classifications can identify different task characteristics. However, there is cause for hesitancy in suggesting further study in more depth and sophistication, due to the conceptually complex and tedious chore for persons asked to rate occupational tasks. Suggestions are made for future studies. Questionnaires (on human attributes, psychological processes, content domains, action processes, and objects of action) are appended along with summary data. (JT)

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IDENTIFYING TRANSFERABLE SKILLS:
A TASK CLASSIFICATION APPROACH

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FOREWORD

The National Center for Research in Vocational Education is continuing its programmatic R&D efforts to develop more effective procedures for curriculum planning and design. This report represents an exploratory study of the feasibility and usefulness of five classification schemes in identifying the transferable characteristics of tasks performed in diverse occupations. This study was part of a larger project of research to investigate the nature and curricular implications of occupational adaptability and transferable skills.

The National Center wishes to express its appreciation to the many vocational instructors and The Ohio State University personnel who gave of their time and energy to participate in the data collection procedure which made this study possible. The extra effort extended by National Center professional staff members who participated in the study is also gratefully recognized.

We particularly wish to express our thanks to Jerome Moss, Jr., University of Minnesota; Marcia Freedman, Conservation of Human Resources; and Calvin W. Taylor, University of Utah, of the project's Panel of Consultants, and to Robert Stump of the National Institute of Education for their comments and suggestions during this study.

Robert E. Taylor
Executive Director
The National Center for Research in
Vocational Education

PROBLEM

Need

Job mobility seems to be a characteristic of the American labor force. A 1972 Census Bureau study (Byrne, 1975) found that over eleven million people, nearly one out of every seven, had changed occupations and/or employers in a single 12-month period. Another study (Sommers & Eck, 1977) reported that between a quarter and a third of the work force changed occupations in a five-year period.

Educators and educational planners are faced with a responsibility and a real concern, not only to prepare people to enter and cope with the world of work, but to enable them to move effectively among employment opportunities as their individual careers unfold. But those "who are faced with helping students to prepare for jobs and careers have little empirical and factual basis on which to base (their) recommendations" (Stump, 1976).

One of the difficulties encountered in trying to understand the nature of and influences upon effective movement between occupations is a lack of knowledge about the relationships between occupations. Both manpower economists and industrial psychologists decry the inadequacies of our present methods of identifying the similarities and differences between jobs, particularly the skills and knowledges required for the performance of each job. Gordon (1967) cited "a ground swell of interest in and criticism of the occupational classification currently used by the U.S. Bureau of the Census (due to) the fundamental lack of relevance of the current scheme in supplying meaningful data for analytical purposes." Fleishman (1975), in discussing the need for the development of concepts on the effects of task training on human performance in different situations, concluded that "what has been lacking is a system for classifying such tasks that would lead to improved generalizations and predictions about how such factors affect human performance." Recognition in education of the need for knowledge about the performance and knowledge relationships among occupations is evidenced in continued efforts to group jobs into meaningful clusters for curriculum purposes (Townsend, 1977).

New approaches are needed in education, for guidance as well as for curriculum purposes, for identifying elements of similarity among occupations. This is especially important where such relationships reflect learned behaviors that can be considered to be developed work skills.

Current practice in relating occupations is directed, in general, toward classifying and comparing jobs as whole entities. Little or no attention appears given to the component tasks that contribute to making up the whole job. Classifying the tasks of two or more occupations as a way of relating a pair (or set) of jobs would appear to be a potentially effective way of discerning the components of those relationships which can be learned in training or education experiences.

Usefulness of Solution

Career education's concern for the breadth of occupational applicability of training across occupations, as well as vocational education's concern for broader applicability of training within an occupation, could be served through improved means of relating occupations. With such a capability, it would be possible to plan better for developing the resources and capacities in individual people through education. The eventual goal would be to develop the capability to plan and produce curricula, instructional materials, and teaching methods to accomplish such people-oriented career development.

From the individual viewpoint, interest ultimately would be on increasing awareness of the potential adaptability and usefulness of already developed skills for other occupational performance situations. We have reasoned that acquired capacities and awareness of transfer opportunities should permit a reduction in the time required for individuals to qualify to perform in another job. The greater the number of behavioral capacities developed for transfer, the broader the range of potential transfer opportunities that become available.

Among particular ways task classification systems might usefully be applied to practical problems are such diverse possibilities as:

1. Empirically establishing a network of job clusters wherein the likely degree and areas of skill transferability among occupations can be specified.

2. Surveying the capabilities of college graduates to identify particular occupations suited to each type of college major.

3. Establishing the construct validity factors by which job applicants can be assessed when direct job performance measures are not available or are inappropriate.

Gordon (1967) suggests that one of the benefits accruing to employers from improved development of job families based on skill content would be the adaptability of workers to changes in technology, along with educational policy to isolate new job positions and, hence, new skills which alter substitution possibilities. Marks and Hook (1963) suggested value to employers in determining "the structuring of jobs and the movement of personnel so as to make optimal use of previous training and experience . . . (with jobs) grouped so that personnel movements among the jobs within the *same* groups require less cross-training time than movements among jobs in *different* groups. . . ."

OBJECTIVE OF THIS STUDY

The study reported here was intended to be a brief, initial exploration of the feasibility of classifying occupational tasks as a basis for understanding better the occupational transferability of job skills. The goal was to see if such a task classification approach has merit for further study, and, if so, to suggest further research and applications that appear meaningful.

It was recognized that a variety of factors and circumstances can affect labor market supply and demand. However, the central concern of this study was the relationship of work skills in facilitating the occupational mobility of workers. The primary focus of this exploratory study was upon the practicality and usefulness of several task classification schemes for identifying interjob relationships based on skill requirements.

APPROACH

General Procedures

To show general skill relationships among occupations we applied five classification schemes to 50 selected task statements for each of 12 occupations. Ratings by five reasonably knowledgeable people were obtained for the tasks of each occupation. A comparison of the task ratings was conducted to determine the skill components or aspects of tasks that would appear to be similar and could contribute to transfer capability among an occupation.

Additional exploration was attempted by obtaining *overall job ratings,* using each classification scheme, for a subsample of four of the occupations. This permitted an examination of the comparibility of task-composition versus whole-job bases for identifying the skill components of an occupation.

One further examination was made with results available from a German study (Hofbauer & Konig, 1972) in which the strength of relationship between occupations was measured on the basis of worker substitutability as judged by supervisors.

The scope of work for this study was intended to capitalize on the project staff's prior work on job performance content and the existing file of task inventories available in their Task Inventory Exchange service.

In approaching the subject of occupationally transferable skills, it seems important to have a concept of what is intended by the terms "transfer" and "skills." It also is recognized that skills may be of different types and levels of specificity. These issues, as well as what elemental components of task statements are available for classification, are discussed in the following sections—as they were perceived for the conduct of this study.

The Concept of Transfer

Presumably, transfer of a skill to a different occupational performance situation can be evidenced by either of two events:

1. New tasks are learned with less time or effort than possible without the previous learned ability.

2. Previous learned behavior is directly and immediately applicable in a different task, whether in the same or some other occupation.

The second of these events is merely one possible instance of the first, where the learning time and effort requirement has been reduced to zero.

Transfer of a skill can be experienced when an existing skill must be used in a context or situation different from that in which it was originally developed or used. One case in which this can occur is when the worker changes from one occupation to quite a different occupation, but some of the same skills are required. An equally important occasion for skill transfer occurs when an existing skill must be applied in the same job but under different circumstances, as might happen when weather or stress conditions change.

The capability for transferring a skill seems to be enhanced when that skill not only has been learned and developed, but when that skill also has been applied in multiple contexts and situations. Thus, if a skill has been learned in context A, and subsequently applied and transferred in contexts B, C, and D, there should be increased assurance that subsequently it can be applied and transferred to context E. Singer (1977), in reviewing instructional strategies for psychomotor skills, suggests that "for those activities that ultimately make varied and often unpredictable demands on the person, . . . experience in an assortment of environments is in order." Thus, there needs to be not only a basic learning of a skill, but also a learning of the skill for transfer.

The Concept of Skills

Skills, as understood here, are not the specific tasks of a job. Rather, they are developed or learned abilities that are *inherent in and required for* task performance. Reading skills may thus be required in many specific job tasks. More than one skill may be required for performance of a particular job task. It is therefore possible for skills to pertain to different component parts of a task.

Types of Skills

While their scope and definition are not yet agreed upon, it can be presumed reasonably that transferable skills underlying task performance can be at least of the following general types:

1. Work-related human attributes, including general vocational and cognitive abilities.
2. Generic literacy skills pertaining to basic communication and computation.
3. Technical skills involving complex manipulative and process capacities.

These categories of skills are not mutually exclusive, but may represent different dimensions by which a skill can be characterized. The latter two may in fact be subsets of the first type.

Affective behaviors generally recognized as reflecting individual attitudes and personality traits may also characterize different styles of work patterns. However, such behaviors were not considered to be skills and no attempt was made in this study to classify them.

Elements of Tasks

Task statements can contain or reflect at least four related elements:

1. Information input used by the worker.
2. Job-oriented actions performed.
3. Objects that are acted upon.
4. Contexts in which the task is performed.

Together these four elements of task statements essentially correspond to the component elements of Miller's (1971a, 1971c) duty modules within which it is hypothesized that skill transfer is

maximized. Miller's duty modules involve *classes* of inputs, actions, objects, and contexts. It is within these duty modules, rather than in specific job tasks, that one would expect to find identifiable performance counterparts in diverse jobs. It thus appears that it is not the specific task behavior that transfers, but the class of behavior involved in a task.

Consider, for example, any set of activities that require skills in grouping or sorting items. We could classify such skills as discrimination skills. We would hypothesize that a person who learns to discriminate between two types of objects according to a set of rules on one task should be capable of transferring that behavior or skill to a new task involving different objects. The individual might need to learn the appropriate rules for discriminating between the new objects, but we would expect the skills of applying the new rules to transfer directly, thus enabling the individual to obtain proficiency in a shorter period of time than on the original task. We suggest that the specific task procedures may not directly transfer, but the discrimination behaviors do transfer.

The breakup of task statements into four elements permits the use of task classification schemes for each component. The assumption is that if the *class* of any three of the four elements were unchanged in a new performance situation, then the change of class for the fourth element should be the focus in assessing the occurrence of skill transfer. Greatest transfer capability then should occur when the class of all four elements does not change in the new application. Whether all elements are equal in their influence upon transfer capability is unknown. However, it appears logical to presume that the more task elements that change class, the less the capacity for transfer of component skills.

PROCEDURES

Task Classification Schemes

Four different approaches to task classification are described by Fleishman (1975, p. 1129-1130) reflecting "four major conceptual bases underlying current task description and classification." These approaches are:

1. *Behavior description approach,* wherein categories of tasks are based upon "what operators actually do while performing a task." These categories typically use terms to represent overt behaviors such as dial setting, meter reading, and soldering."

2. *Behavior requirements approach,* which involves "cataloging tasks in terms of the types of processes required for successful performance." Typical of the functions used to differentiate among tasks are scanning function, short-term memory, long-term memory, decision making, and problem solving.

3. *Ability requirements approach,* wherein tasks are characterized "in terms of the abilities that a given task requires of the operator." Though somewhat similar to the behavior requirements approach, these abilities "are treated as more basic units than the behavior functions." They are "relatively enduring attributes of the individual performing the task."

4. *Task characteristics approach,* which describes tasks in terms of a variety of task-intrinsic objective properties they may possess, including goals, stimuli, procedures, response characteristics, and task content.

Five classification schemes were chosen for tryout in this study. One was intended to categorize one general type of skill underlying task performance: work-relevant human attributes. Four schemes were intended to represent three of the four elements of a task statement: (a) two schemes were used to categorize the work actions involved in a task, (b) one scheme was for information inputs, and (c) one was for the objects acted upon.

For the fourth task element, context of task performance, no ready-made categorization scheme was known to exist. The nature of possible situational variables seems very diverse, ranging from matters of organizational climate to performance pressures and standards. Thus, while no attempt was made to classify the performance contexts of tasks, the project staff did try to make up a list of context variables. These are reported in Appendix A for the reader's information.

Classification of Underlying Skills

Forty-two human attributes were selected from those used by Cunningham in his Occupation Analysis Inventory (Neeb, Cunningham, & Pass; 1971). These consisted of 24 general vocational capabilities and 18 cognitive capacities. Together, these 42 attribute categories were used to characterize the human process abilities that appear needed in the performance of a task. Psychomotor and sensory abilities, though included among Cunningham's list of attributes, were omitted to force rater attention to the more unusual descriptors of tasks in the skilled trades. Cunningham's definitions of each attribute were slightly edited to increase their readability by the raters to be used in this study. Additionally, a couple of the cognitive capacities listed by Cunningham were omitted because of their rare usage and their complex definitions. The short title of the 42 used are shown in Table 1. The full definitions of each category may be found in Appendix B.

Table 1

Human Attributes Used to Classify Underlying Skills of Tasks

	General Vocational Capabilities		Cognitive Capacities
1	Tools	25	Form Perception
2	Physical & Mechanical Systems	26	Perceptual Speed
3	Stationary Machine & Equipment Operation	27	Spatial Scanning
4	Vehicle Operation	28	Spatial Orientation
5	Connections & Fittings	29	Visualization
6	Fluid Systems	30	Number Facility
7	Measuring Instruments	31	Memory
8	Electricity	32	Verbal Comprehension
9	Layout & Visualization	33	Grammar
10	Structures	34	Spelling
11	Medical and First Aid	35	Expressional Fluency
12	Materials	36	Ideational Fluency
13	Chemicals	37	Sensitivity to Problems
14	Foods and Cooking	38	Deductive Reasoning
15	Biological Systems	39	Originality
16	Arithmetic Computations	40	Social Intelligence
17	Arithmetic Applications	41	Aesthetic Judgment
18	Clerical	42	Musical Talent
19	Verbal Communication		
20	Sales		
21	Service		
22	Dealing with Social Situations		
23	Etiquette and Social Grace		
24	Style and Grooming		

This use of Cunningham's attributes corresponds to what Fleishman (1975) called the "ability requirements approach" to task classification. By this approach tasks are "described, contrasted, and compared in terms of the abilities that a given task requires of the operator."

Classification of Task Elements

Two different classification schemes were taken directly from Altman's (1966) study of general vocational capabilities. One of Altman's schemes represents task actions performed. This set contains 12 categories of psychological processes. Use of this scheme corresponds to what Fleishman (1975) describes as the "behavior requirements approach" to task classification, "cataloging tasks in terms of the type of processes required for successful performance." The other scheme represents at least an array of general types of information input used in task performance. There are six categories of these content domains. This scheme represents a partial application of what Fleishman (1975) calls the "task characteristics approach." Short titles for each are shown in Table 2, with full definitions available in Appendix C.

Table 2

Psychological Processes and Content Domains Used to Classify Task Actions and Information Input

	Psychological Processes		Content Domains
1	Sensing	1	Mechanical
2	Detecting	2	Electrical
3	Chaining or Rote Sequencing	3	Spatial/Structural
4	Discriminating or Identifying	4	Chemical and Biological
5	Coding	5	Symbolic
		6	People
6	Classifying		
7	Estimating I (discrete case)		
8	Estimating II (or Tracking)		
9	Logical Manipulation		
10	Rule Using		
11	Decision Making		
12	Problem Solving		

An alternative means for classifying task actions performed was selected from Miller (1971b, 1974). Some 23 action processes were developed by Miller to reflect the information processing actions of computerized systems, though conceptually they might well reflect a broad range of worker actions, much as one might use the therbligs devised for industrial engineering years ago by Gilbreth. Their short titles are listed in Table 3, with category definitions reported in Appendix D. As with Altman's (1966) psychological processes, Miller's action processes also correspond to the "behavior requirements approach" to task classification.

Table 3

Action Processes and Items Acted Upon Used to Classify Task Actions and Objects

	Action Processes		Types of Items Acted Upon (Objects of an Action Process)
1	Input Select	1	Data
2	Filter	2	People
3	Queue to Channel	3	Things
4	Detect		
5	Search		
6	Identify		
7	Code		
8	Interpret		
9	Categorize		
10	Transmit		
11	Store		
12	Short-Term Memory		
13	Compute		
14	Count		
15	Decide/Select		
16	Plan		
17	Test		
18	Control		
19	Edit		
20	Adapt/Learn		
21	Display		
22	Purge		
23	Reset		

To provide at least a general classification of objects acted upon in task performance, the Data-People-Things designations defined by the *Dictionary of occupational titles* (U.S. Department of Labor, 1965) were selected as the fifth classification scheme. These, too, are noted in Table 3 and Appendix D.

Together these five classification schemes provided a means for characterizing several component features of specific tasks, as well as an array of methods for noting the classes of skill attributes that may underlie performance of a task. These particular classification schemes were chosen because of (a) their apparent capacity to be applied readily at the task level of work description, (b) their prior development from extensive empirical research or the experience of highly reputable professionals, and (c) a hunch that these schemes might effectively identify elements of transferability that would be useful in building a foundation for developing curricular programs to impart skill transfer.

It was recognized that some portions of these classification schemes are over simplified. However, it was felt that there is enough specificity to determine if this approach is a useful one. If so, there may be value to extending task classifications into more detail in future studies.

Questionnaire Forms

Forms to obtain separate task ratings. The five classification schemes were incorporated into three questionnaires for analyzing tasks. Because of its length, Cunningham's list of human attributes, identified in the study as Form A, comprised one questionnaire. Altman's two schemes (Forms B and C) were contained on the second questionnaire. The third questionnaire consisted of Miller's action processes (Form D) in combination with the Data-People-Things types of action objects (Form E). The instructions, formats, and category definitions are given in Appendices B, C, and D. Each rater for an occupation was intended to respond to all three questionnaires. Sets of 50 tasks were listed for each of the 12 occupations included in the study.

Form A, using Cunningham's 42 attributes, asked raters to identify for each task statement no more than 6 to 10 of the human process abilities that they judged to be essential to the performance of that task.

Forms B and C, using Altman's 12 psychological processes and six content domains, asked each rater to select for each task the one process and the one domain that best described the nature of what a worker does in performing that task.

Forms D and E, using Miller's 23 action processes and the three D-P-T categories of objects acted upon, again asked for the one most appropriate process and the primary object of the task action.

Forms to obtain overall job ratings. In order to determine the relative differences and/or similarities in the measures obtained by the task rating procedure versus the more traditional whole-job rating procedure, a second set of instruments was developed for each of the five classification forms. It seemed important and logical to determine if the more complex task rating procedure would provide information that was different from and superior to that obtained from the simpler whole-job rating approach.

A second set of instruments was developed for each of the five classification forms. These were applied to a subset of four of the 12 occupations used in the study. The intent here was to obtain somewhat comparable ratings, but for an occupation as a whole unit instead of for each component task. The forms were designed to allow raters to indicate the degree of involvement or requirement for the occupation as a whole, on a 0-7 scale, of each attribute, process, action, domain, and object category. These instruments were much easier to complete than their task-rated counterparts.

Job Sample

Several criteria dictated by the resources allocated for the effort and consistent with its exploratory nature, were applied in arriving at the selection of 12 occupations employed in the study. The occupations were to be of vocational training interest. They also should involve tasks which are generally understandable by raters who are only reasonably knowledgeable of the occupation. The occupations were not to include highly technical or professional occupations, such as in electronics, medicine, or law, as such occupations typically involve technical terminology that would restrict our availability of knowledgeable raters. The occupations selected were to require a significant amount of specialized training, however. And, they were to represent a range of different

conditions of occupational relationships that would appear to reflect various degrees of transfer capability. Another factor in selecting the occupations to be studied was the availability of usable task inventories on file in the Task Inventory Exchange (TIE) operated by the National Center for Research in Vocational Education.

To acquire a priori occupational groupings that could be considered to be different, the occupations were identified by the first two digits of Holland's (1973) SDS (Self-Directed Search) Summary Codes, and also by their relationships with Data, People, and Things as expressed by the second set of three digits in the *Dictionary of occupational titles* (U.S. Department of Labor, 1965).

An examination of the TIE holdings resulted in the following findings:

1. Most of the inventories available are for occupations of Realistic (R) and Investigative (I) personality types, according to Holland's SDS Summary Codes.

2. Similarly, *Things* are most often the object acted upon by the majority of those occupations; with *Data* objects next most frequent and *People* objects least frequent.

Thus, occupations characterized as RI (Realistic-Investigative) and involving Things (T) as objects were prime candidates for selection. At the opposite extreme of available types were those depicted as Enterprising (E) and Social (S), acting upon Data types of action objects.

It was then determined that the following possible groups of occupations were available for selection, to represent varying degrees of association:

	Holland Code	D-P-T Level[a]
Group 1 Occupations:	RI	T
Group 2 Occupations:	RI	dT
Group 3 Occupations:	RI	DT
Group 4 Occupations:	RI	D
Group 5 Occupations:	ES	D

[a]Distinctions were made between levels of D-P-T functions. *Capital* D, P, or T represent a high performance complexity level with a DOT code of 0, 1, or 2. *Lower case* d, p, or t represent a medium complexity level with a DOT code of 3, 4, or 5. *No entry* in the chart above represents a low complexity level with a DOT code of 6, 7, or 8.

Given these five sets of occupational groups, the following paradigm portrays increasing occupational differences between groups on Holland's Personality Characteristics and in the Data, People, Things level of involvement per the DOT.

Holland's Personality Characteristics	Things – Data – People Level of Involvement									
	T	dT	DT	Dt	t	d	D	dp	Dp	DP. . .
RI	Gp1	Gp2	Gp3	. . . . .			Gp4	. . . . .		
RE							.			
SI, RS, SR							.			
EC, SA, CS							:			
SC							.			
ES							Gp5			

Based upon these a priori groupings it was then reasonable to hypothesize that:

1. Occupational differences within a group are less than differences between occupations in different groups.

2. Differences between Groups 1, 2, and 3 are increasingly greater due to differing DOT functions.

3. Greatest between-group differences occur between occupations in Group 1 and those in Group 5, due both to differing Holland and DOT categories.

4. Next-greatest between-group differences occur between Groups 1 and 4, and between Groups 4 and 5.

5. Least intergroup differences occur between Groups 1 and 2, and between Groups 2 and 3.

6. If Holland types are a more powerful determinant of differences and similarities than are DOT functions, then larger differences should occur between (Groups 1, 2, or 3) and Group 5, than between (Groups 1, 2, or 3) and Group 4.

7. If DOT functions are a more powerful determinant of differences and similarities than are the Holland types, then larger differences should occur between Groups 1, 2, and 3, than between Groups 4 and 5.

Another consideration in selecting occupations for the study was the desire to include several of the occupations represented in the Hofbauer and König study (1972), to permit at least some comparison of results on occupational relationships.

Twelve occupations meeting the prescribed criteria were identified that provided representation of each of five groups, with seven of the 12 comparable to those in the Hofbauer and König study. Many task inventory options were available within Groups 2, 3, and 5. In those situations where there were a large number of inventories, selection was made on the basis of the quality and number of the task statements in the inventory.

The 12 occupations selected are listed below according to the a priori group they represent. Those comparable to occupations in the Hofbauer and König study are indicated by an asterisk.

Realistic-Investigative

Group 1:	RI – T	*Baker Printer (litho/offset)
Group 2:	RI – dT	*Auto Body Repair *Carpenter (construction) *Plumber
Group 3:	RI – DT	*Auto Mechanic Dairy Farmer *Machinist
Group 4:	RI – D	Nurseryman (horticulture)

Enterprising – Social

Group 5:	ES – D	Administrative Assistant Property Manager (Apartment) *Retail Merchant

Task Selection and Editing

Several source documents in the Task Inventory Exchange files were searched to obtain the most useful and highest quality of task inventories for each of the 12 selected occupations. Inventories that had well written task statements and/or a large number of statements were located.

Task statements were selected and edited to obtain a representation of the type of work performed in each occupation. The intention was to produce task statements with the specificity, structure, and clarity prescribed by earlier program work (Ammerman, 1977). A total of 50 tasks per occupation were selected. At least 10 tasks in each occupation were of relatively high significance and/or rate of job occurrence. A total of 600 tasks over all 12 occupations thus was identified, each to be classified by each of the five schemes.

Administration

Raters from three different groups volunteered their efforts. Secondary Vocational Education instructors, Ohio State University (OSU) personnel, and National Center for Research in Vocational Education professional and support staff constituted three groups. Five raters per occupation completed the task rating process.

The initial efforts to locate potential raters were directed toward vocational education programs in the central Ohio area. Contact was made with the directors of vocational schools that offered programs representing most of the 12 selected occupations. Permission to call on the instructors of the programs was obtained. Four schools were visited and selected instructors were asked to complete a set of five task rating forms on a voluntary basis. A project staff member explained the instructions for completing each form. A set of forms and return envelope were provided to those indicating a willingness to cooperate. A total of 27 vocational instructors accepted the forms and indicated their intention to complete and return the instrument within a week.

Although the administrators of the four schools were very cooperative, it was recognized that the close of the school year was near and instructors had other responsibilities that would have to take priority over the rating process.

A total of 25 people on the National Center staff who had related work experience or knowledge were identified. Each person was given a set of rating forms and instructed on the procedure for completing the forms.

Contact with Ohio State University personnel resulted in securing raters for the final eight instrument sets. Five of these were distributed to work-study students who had a dairy farm background and were employed at the OSU Dairy Barn. One individual was an administrative assistant in the College of Agriculture and two were employees with the campus-based Vocational Instructional Materials Laboratory.

Of the 27 instrument sets distributed to vocational instructors, 13 usable returns were received. All instruments distributed to National Center staff were returned and six of the eight instruments distributed to OSU personnel were returned.

Project and several other National Center staff members were required to complete instruments in place of the non-respondents. The number of usable returns from the first distribution of instruments is shown in Table 4.

Table 4

Usable Returns from the Initial Distribution of Task Rating Instruments by Group

Occupation	Vocational Education Instructors		National Center Staff		OSU Staff	
	Distributed	Returned	Distributed	Returned	Distributed	Returned
Admin. Assistant			4	4	1	1
Auto Body Repair	3	1	2	2		
Auto Mechanic	3	3	2	2		
Baker	3	0	2	2		
Carpenter	4	2	1	1		
Dairy Farmer					5	4
Machinist	4	3	1	1		
Nurseryman	3	1	2	2		
Plumber	2	1	3	3		
Printer	3	0			2	1
Property Manager			5	5		
Retail Merchant	2	2	3	3		
TOTAL	27	13	25	25	8	6

Based on notations and comments provided by respondents and noncompleters of the task rating instruments, it was apparent to the project staff that the length, complexity, and number of discriminations required were highly detrimental to successful completion of the forms. Due to the length of Form A and the the large number of potential discriminations required there appeared to be a considerable decline in the raters' attention to subsequent forms when Form A was completed first.

When the follow-up set of task rating instruments were distributed to project and other National Center staff members to compensate for nonrespondents, they were asked to complete Forms D and E first, then Forms B and C, and finally Form A. It was hoped this reversal would provide for a better distribution of ratings, particularly on Forms B and D. A review of the returns did indicate that Form B and D ratings appeared to have been completed in a more discerning manner. All follow-up job rating instruments were returned and usable. However, respondents continued to report that they still found the time requirements and complexity of the task rating forms to be excessive.

Four of the 12 occupations were classified according to the whole-job rating procedure for each classification scheme. Potential raters were again selected from National Center staff and OSU personnel who had not been involved in the initial task rating process. Three people for each occupation were provided with a job rating form and instructions. All of these were completed and returned. The distribution of instruments for each occupation is shown in Table 5.

Table 5

Distribution of Job Rating Instruments by Group

Occupation	National Center Staff	OSU Staff
Admin. Assistant	3	0
Dairy Farmer	3	0
Machinist	0	3
Printer	1	2
TOTAL	7	5

A comparison of the average time required to complete the task rating and job rating instrument sets indicated a considerable reduction for the job rating approach over the task rating approach as shown in Table 6.

Table 6

Average Time Required to Complete Rating Forms

Type of Form	Average Time in Minutes
Task Rating Forms	120
Job Rating Forms	30

Measures of Rater Agreement

The objective was to see if the occupations are similar on the basis of each of the five classification schemes used. To establish this similarity, two sequential steps were involved, one examining the number of raters judging that a classification category did pertain to each task, the other then noting how many tasks in a job required that classification category.

Step One: Is the classification element (action, attribute, process, or content) relevant to or required *by a task?* Yes, if a sufficient number of raters agreed upon that relevance. In every instance at least three of the five raters had to agree before we would conclude that the classification category did relate to the task.

Step Two: Is the classification element relevant to or required *by the job?* In this case the same number of raters had to agree, but we required that a sufficient number of tasks be related to the element before we would say it was characteristic of the job. For Forms A and C (attributes and content domains) we required that at least three tasks be related to a classification category.

To illustrate the Plumber occupation, using Form A attribute totals, Table 7 shows for a few attributes: (a) the number of the times the five raters said a task required that attribute, (b) the number of tasks on which rater agreement was achieved for that category, and (c) whether that attribute category can be considered to be required in that occupation. In this illustration, Attribute 1 (Tools) was related to some task a total of 168 times. In 33 of the possible 50 task cases three or more of the raters agreed upon the attribute. Since the number of tasks on which the raters agreed is more than three (i.e., 33), we are saying that the use of tools is a requirement of the job of Plumbers. On the other hand, Attribute 28 (Spatial Orientation), receiving a total of 34 indications of its task relevance, achieved in only one instance a majority of the five raters agreeing on its relevance to a particular task. We are saying that capacity for spatial orientation is not characteristic of the job of Plumbers because only one task was related to this element by the requisite number of raters.

Table 7

Sample Total Count and Consensus of Attribute Ratings (Form A)

Categories of Human Attributes		No. of Times That Each Attribute was Judged Relevant to a Task	No. of Tasks Requiring Attribute, As Agreed by 3 or More Raters	Attribute Considered to Be Required by Job
1	Tools	168	33	Yes
2	Physical & Mechanical Systems	62	6	Yes
	.	.	.	.
	.	.	.	.
	.	.	.	.
	.	.	.	.
	.	.	.	.
	.	.	.	.
16	Arithmetic Computation	55	3	Yes
	.	.	.	.
	.	.	.	.
	.	.	.	.
28	Spatial Orientation	34	1	No
	.	.	.	.

Note: Up to a total of 250 ratings are possible per attribute, with 50 tasks rated by five persons.

The rule of having at least three tasks to denote the *job* relevance of a classification element was modified to accommodate the actual response patterns resulting from Forms B, D, and E. Forms B and D (Altman's 12 psychological processes and Miller's 23 action processes) yielded too few classification categories on which as many as three tasks were relevant. The rule for these was therefore reduced to *one* task for these forms, to provide some range of useful occupational characterization. Form E (the DOT's three D-P-T types of action objects) yielded too many categories, often all three for an occupation. In this instance, the rule thus was extended to require at least *six* tasks before we were willing to conclude that a particular object type was characteristic of the occupation for our present exploratory study.

Measures of Job Relationships

As noted above (Table 7), three measures are available to serve as a basis for comparing occupations on a classification scheme:

1. *Frequency count* of the number of times a classification category was used by the five raters of an occupation.

2. *Number of tasks* requiring a classification category.

3. *Relevance or requirement* of a classification category for a particular occupation.

Each of these measures were used to identify relationships between occupational pairs by each classification scheme.

Based on frequency counts. Parallel tallies of the number of tasks requiring each classification element were used with each pair of occupations to calculate Σd^2, the sum of the squared differences between the task tallies of each category in the classification. This statistic, Σd^2, is useful in comparing the relative extent to which each occupation received similar ratings on a classification scheme.

It is computed by taking the number of tasks determined to require each classification category for each of two occupations, finding the numerical difference (d) between them, and squaring that difference (d^2). The d^2 values are then summed (Σd^2) across all categories of a classification scheme. The smaller this sum of d^2, the greater the similarity between the classification profiles of the pair of occupations, suggesting a close association between them in regard to the elements of the particular classification scheme.

For example:

Classification Category	Number of Tasks Requiring Each Category: Job A	Job B	d	d^2
1	33	43	10	100
2	6	16	10	100
3	0	1	1	1
4	0	9	9	81
5	28	16	12	144
6	6	9	3	9
				Σd^2 = 435

It should be cautioned, however, that Σd^2 cannot be compared across different classification schemes, since each scheme results in a different range of possible Σd^2 values. Comparisons are meaningful only for occupational pairs within a particular classification form.

This measure was used for testing the directional hypotheses that were derived for the job groupings, as stated in the Job Sample section above. Matrices of all possible pairs of occupations also were examined for apparent clusters of occupations based on this measure of job relationship.

Based on number of tasks requiring a category. Separately for each of the five classification schemes, the number of tasks requiring each category were listed. These numbers in turn were converted to more general groupings of NO – LOW – MEDIUM – HIGH level of evidence of task requirement for each category. These groupings were assigned as follows:

Grouping	Basis for Grouping
NO	*No tasks* on which there was any agreement for the relevance or requirement of that classification category.
LOW	*From 1 to 4 tasks* required the classification category.
MEDIUM	*From 5 to 9 tasks* required the classification category.
HIGH	*10 or more tasks* required the classification category.

These groupings were then used to provide visual profiles of each occupation in relation to other occupations, by plotting the rating group for each classification category across all 12 occupations. These matrices, one for each of the five classification schemes, allow the reader to quickly examine the major areas of occupational similarity and difference, based on the degree of task evidence of their relevance.

Based on existing development of category. Parallel listings denoting the relevance of a classification category for pairs of occupations were used to calculate the percent of time that categories were shared in common by those occupations. As noted above under the section on Measures of Rater Agreement, at least three tasks must require a classification category on Forms A and C for that category to be considered as relevant to the occupation and required by that occupation. For Forms B and D only one task was needed, and six tasks for Form E.

This information was then used in the following formula to calculate the overlap of categories in a pair of occupations:

$$\frac{C}{X + Y - C} = \text{Percent of available relevant categories held in common by jobs X and Y.}$$

Where: C = number of categories relevant to both jobs.

X = number of categories relevant to job X.

Y = number of categories relevant to job Y.

This is a measure of the percent of classification categories that are shared by a pair of occupations, of all those possible to be shared. The formula subtracts C from the sum of X and Y to take out the double count of overlap between X and Y.

Matrices reflecting percentages of categories shared by a pair of occupations were prepared for each classification scheme.

These values were then used to (a) group occupations into job clusters, and (b) note how often each classification category served to identify a relation among occupations.

RESULTS

Hypothesis Testing

Recall that the 12 occupations selected for investigation represented five groups that were hypothesized to be different. The differences were related according to Holland's SDS Summary Codes and according to their relationships to Data, People, and Things as expressed in the *Dictionary of occupational titles.*

Upon examination of the paradigm constructed to reflect potential differences in the location of the five groups of occupations, seven directional hypotheses were formulated as listed in Table 8. An abbreviated version of the paradigm is presented below.

Data – People – Things Degree of Involvement
(Limited Scale)

Holland's Personality Characteristics	T	dT	DT	...	...	...	D
RI	Gp1	Gp2	Gp3	...	...	...	Gp4
–							,
–							,
–							,
–							,
ES							Gp5

It can be seen that between Groups 1, 2, 3 and 4 there is an increasing difference in the relationship to Things and Data. No occupations were selected with high or medium relationship to People due to the lack of available task inventories for such occupations.

Table 8

Classification Scheme Support of
Directional Hypotheses

Classification Scheme						Directional Hypotheses
A Attribute	B Psychological Process	C Content Domain	D Action Process	E DPT Objects		
+	–	+	–	+	1.	Within-group differences are less than between-group differences.
–	+	+	+	+	2.	Differences between Groups 1, 2 and 3 are increasingly greater.
+	–	+	–	+	3.	Greatest between-group difference occurs between Groups 1 and 5.
–	–	–	–	–	4.	Next greatest between-group differences occur between Groups 1 and 4, or between Groups 4 and 5.
–	–	+	–	+	5.	Least between-group differences occur between Groups 1 and 2; and between Groups 2 and 3.
+	–	+	–	+		
+	–	+	–	+	6.	If Holland's Personality Characteristics are a much more powerful determinant of differences and similarities than are DOT's D-P-T functions, then larger differences should occur between (Groups 1, 2 or 3) and Group 5, than between (Groups 1, 2, or 3) and Group 4.
+	+	–	+	–	7.	If DOT's D-P-T functions are a much more powerful determinant of differences and similarities than are the Holland Personality Characteristics, then larger differences should occur between Groups 1, 2 and 3, than between Groups 4 and 5.

Note: + = Supported by Scheme
– = Not Supported by Scheme

The major difference between Group 4 and 5 is the degree of remoteness on the Holland scale. Group 5 is most distant from Group 4 but shares the same high relationship to Data. The hypotheses were tested by comparing the sum of the squared differences (Σd^2) between the 66 possible pairs of the 12 occupations. Tables of the relationship measures for each set of data are included in Appendix E. These measures were computed from the distributions of classification ratings for each occupation as recorded in Appendix F, which also records rater agreement on tasks in a classification category.

The data were compared to determine which classification schemes supported or rejected the directional hypotheses. The findings of this review are indicated in Table 8. The hypotheses were

generally supported by the data and there is a moderate degree of consistancy between classification schemes. Six of the hypotheses were supported by at least three classification schemes, with hypothesis number two supported by four of the five schemes. Hypothesis number 4 was rejected by all five schemes.

Classification Agreement

An analysis was conducted to determine the extent of agreement on the specific categories of each classification scheme across all 12 occupations. The number of times that a task received the same rating by three or more raters was again used as the basis of consensus. The number of *tasks* that received a consensus of three raters on a classification scheme category were tallied. The ratings were coded as either No, Low, Medium, or High. A category that carried from 1 - 4 tasks was rated low. A medium rating was assigned to a total of 5 - 9 tasks, and 10 or more tasks was rated as high. The ratings for each category of each scheme were plotted across all 12 occupations.

The comparisons for the Form A (Human Attribute) count across each occupation is shown in Table 9. It can be seen that most of the 42 attributes received a Low rating (less than five tasks) across the 12 occupations. A total of 26 attributes were carried on 5 - 9 tasks for a total of 45 Medium ratings across the 12 occupations. A total of 24 attributes were carried by 10 or more tasks, for a total of 51 High ratings across all occupations.

Low agreements tended to be well distributed across the 42 attributes. The medium and high levels of agreement were clustered around Attributes 1 through 18 for the Realistic Investigation (RI) occupational groups and around Attributes 19 through 42 for the Enterprising-Social (ES) group. The RI groups were predominately characterized by the attributes reflecting an emphasis on the use and/or knowledge of concrete objects and materials. The ES group was characterized by the attributes that emphasize cognitive and communications skills and social capacities.

An examination of the data from Form B (Psychological Processes) revealed levels of agreement lower than obtained on Form A and the ratings were less dispersed across the 12 psychological processes, as indicated in Table 10. Process 3, chaining or rote sequencing, received a high level of agreement on 10 of the 12 occupations. Only one other process, Rule Using (10), received a high level of agreement on one occupation. The names and definitions of the psychological processes listed on Form B appeared to be problematic for most raters.

A more anticipated distribution would have indicated high levels of agreement on processes 9 through 12 for the ES group. The tasks in the ES group that received high agreement on the cognitive attributes on Form A received low agreement on the more cognitive psychological processes of Form B.

The ratings on Form C (Content Domains) display a pattern more like that of Form A, as indicated in Table 11. Three RI groups are most characterized by a relationship to mechanical knowledge while one RI occupation and the ES group were rated highest on symbolic knowledge. This would generally correlate with the cognitive aspects of the ES occupations and the one RI job as indicated by their high relationship to Data according to the Data-People-Things scale.

In comparing Forms A, B, and C it might be reasoned that the raters perceived the tasks of the ES occupations as requiring cognitive attributes (Form A), involving symbolic content (Form C) but requiring routine or rote procedures (Form B).

Table 9

Level of Attribute Agreement Across 12 Occupations (Form A Data)

Form A Categories	RI – T		RI – dT			RI – DT			RI–D	ES – D		
	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nursery Worker	Administrative Assistant	Property Manager	Merchant
1. Tools	·	○	●	●	●	●	●	●	●			·
2. Mechanical	·	●	○		○	●	·	·	·			
3. Machine	·	●	·					●	·			
4. Vehicle						○	●		·			
5. Connections					●	●	○					
6. Fluid Systems		·	·		○	○	·					
7. Measuring	·	○	·	●	○	●	●	●	○			
8. Electricity		·	·			○	·					·
9. Visualization		●	·	●	·			·	·	·		
10. Structures			○	○	●							
11. Medical	·											
12. Materials		●	○	·	○	·	·	●	·	·		·
13. Chemicals	·	○	○			·	·					
14. Food	●											
15. Biological							●		·			
16. Arithmetic Comp.	·	·	·	○	·	·	○	●	○	○	·	●
17. Arithmetic Appl.	·	·	·	○	·	·	○	·	●	○	○	●
18. Clerical	·	·	·		·	·			●	●	●	●
19. Verbal	·	·	·		·	·			●	●	●	●
20. Sales						·	·		○	·	·	·
21. Service	·				·	·			·		·	
22. Social	·								·	·	○	○
23. Etiquette								·	·	·	·	○
24. Grooming						·				·		·
25. Form Percept.		·	·			·		○	·	·	·	
26. Perceptual Speed						·		·	·	○		
27. Spatial Orient.		·	·		·				·		·	·
28. Visualization		○		○	·	·		○	·	·	·	·
29. Numbers	·				·			·	·	○	·	●
30. Memory						○		○	·	●		
31. Verbal Comp.	·				·				○	●	○	
32. Grammar		·			·	·			·	●	○	
33. Spelling	·	·				·			·	●	○	
34. Expressional	·					·				●	○	○
35. Ideational										·		·
36. Problems	·				·	·	·	·	○	·	●	○
37. Deductive Reason	·		·						·	○	·	○
38. Originality	·								·	·	·	·
39. Social Intell.	·								·	·	·	·
40. Aesthetic	·	·	·						·	·	·	·
41. Musical												
42. Spatial Scanning					·				·			·

Blank = 0 tasks ○ = 5-9 tasks
· = 1-4 tasks ● = 10+ tasks

Category labels above are abbreviated, refer to Appendix B for full definitions.

Table 10

Level of Process Agreement Across 12 Occupations (Form B Data)

Form B Categories	RI – T		RI – dT			RI – DT			RI–D	ES – D		
	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nursery Worker	Administrative Assistant	Property Manager	Merchant
1. Sensing												
2. Detecting			·									
3. Chaining	●	●	●	●	●	●	·	·	●	●	●	●
4. Discriminating		·	·			·	·	·				
5. Coding		·	·						·		·	
6. Classifying								·				
7. Estimating I												
8. Estimating II			·					·				
9. Logical												
10. Rule Using	·	·		·	·		●		·	·		
11. Decision Making	·	·			·		·		·	·	·	·
12. Problem Solving						·	·					·

Blank = 0 tasks
· = 1-4 tasks
○ = 5-9 tasks
● = 10+ tasks

NOTE: Category labels above are abbreviated, refer to Appendix C for full definitions.

Table 11

Level of Content Domain Agreement Across 12 Occupations (Form C Data)

Form C Categories	RI – T		RI – dT			RI – DT			RI–D	ES – D		
	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nursery Worker	Administrative Assistant	Property Manager	Merchant
1. Mechanical	·	●	●	●	●	●	●	●	○			
2. Electrical							·					
3. Structural	○		·	●	·			·	·	·	·	
4. Chemical	●		○				●		○			
5. Symbolic	○	·	·	·	○	·	·		●	●	●	●
6. People	·				·				○	·	○	○

Blank = 0 tasks
· = 1-4 tasks
○ = 5-9 tasks
● = 10+ tasks

NOTE: Category labels above are abbreviated, refer to Appendix C for full definitions.

The responses on Form D (Action Processes) are the least robust and most questionable of the set of five. Although the distribution of ratings cluster around the RI-D and ES-D occupational groups, high or medium levels of agreement were not obtained in those groups. High levels of agreement occur in only four occupations and account for only three of the 23 action processes. The tallies are arrayed in Table 12.

Table 12

Level of Action Agreement Across 12 Occupations
(Form D Data)

	RI – T		RI – dT			RI – DT			RI–D	ES – D		
Form D Categories	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nursery Worker	Administrative Assistant	Property Manager	Merchant
1. Input												
2. Filter												
3. Queue		·			·						·	·
4. Detect			·									
5. Search					·		·				·	·
6. Identify												
7. Code			·		·							
8. Interpret								·				
9. Categorize												
10. Transmit	·						·		·	·		
11. Store		·							·	·	·	
12. Memory												
13. Compute	·	·	·				·		·	·	·	·
14. Decide	·	·		·	·		·		·	·	·	·
15. Plan	·	·	·		·				·		·	·
16. Test	·		·		·	●	·	·	·	·	·	
17. Control	·	●	●				·	●	·	·	·	
18. Edit		·	●				·		·	·		·
19. Adapt												·
20. Display	·				·					·	·	·
21. Purge	·								·			
22. Reset												
23. Count										·	·	·

Blank = 0 tasks
· = 1-4 tasks
○ = 5-9 tasks
● = 10+ tasks

NOTE: Category labels above are abbreviated, refer to Appendix D for full definitions.

The RI occupational groups also rated a number of the action categories between numbers 13 and 19. A high level of agreement on action processes 17 (Test), 18 (Control), and 19 (Edit) were achieved by Printer, Auto Body, Auto Mechanic, and Machinist. This indicates that a large number of tasks were assigned those categories to the exclusion of others.

The data from Form E (Object Types), as shown in Table 13, indicates an overall pattern consistent with the assigned group relationship to Data, People, and Things. A high level of agreement on Things objects across the RI groups appears to be consistent with results from Forms A and C. No explanation is readily available for the apparent lack of Data tasks for the RI-DT occupational types. It may be that their measurement skills were not well represented by the tasks sampled in those occupations.

Table 13

Level of Object Type Agreement Across 12 Occupations (Form E Data)

	RI – T		RI – dT			RI – DT			RI–D	ES – D		
Form E Categories	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nursery Worker	Administrative Assistant	Property Manager	Merchant
1. Data	●	·	·	○	●	·	·	·	●	●	●	●
2. People	·				·		●		○	·	●	○
3. Things	●	●	●	●	●	●	●	●	●	○	●	○

Blank = 0 tasks
· = 1-4 tasks
○ = 5-9 tasks
● = 10+ tasks

NOTE: Category labels above are abbreviated, refer to Appendix D for full definitions.

The ES group again received high agreement on the Data relationship of the occupation, also consistent with Forms A and C. Because a majority of ratings attained high levels of agreement for 2 of the 3 categories, the Form E data did not discriminate between occupations as well as did the other schemes.

Classification Sensitivity: Job Relationships

The relationship between job pairs was further examined by determining the percentage of scheme categories held in common by each pair of jobs, according to the formula discussed earlier in the section on Measures of Job Relationships:

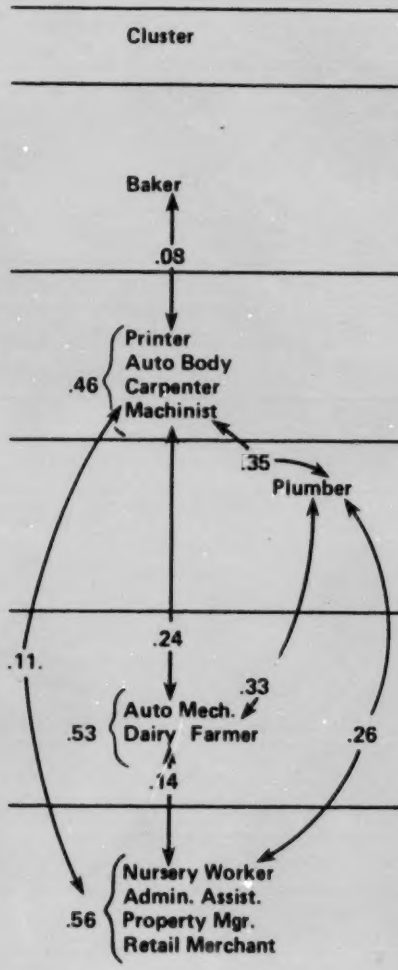
$$\frac{C}{X + Y - C} = \text{Percent of available "existing" categories held in common by jobs X and Y.}$$

Form A. The data from Form A (Human Attributes) produced the cluster shown in Table 14. The average measures of relationship of occupational pairs within and between clusters are noted. The primary shared attributes are listed to the right of the cluster, next to a listing of secondary or lesser-shared attributes. Two major groups were developed. Four RI type occupations clustered together to include Printer, Auto Body, Carpenter, and Machinist. A second group included the three ES occupations and one RI occupation. This group consists of Administrative Assistant, Property Manager, Retail Merchant, and Nursery Worker.

Table 14

Job Relationship Cluster Based on
Human Attributes in Common

Form A



Cluster	Attributes Shared by Groups ++	+
Baker .08	Foods & Cooking	Chemicals Arith. Applic. Verbal Comm. Spelling Originality Aesthetic Judg.
Printer Auto Body .46 Carpenter Machinist	Tools Materials Visualization	Phys. & Mech. Systems Measure Instr. Layout & Visual Materials Arith. Comput.
.35 Plumber	Tools Connections & Fittings Structures	Phys. & Mech. Systems Measure Instr. Layout & Visual Materials Arith. Comput.
.24 .11. .33 Auto Mech. .53 Dairy Farmer .26 .14	Tools Vehicle Opr. Connections & Fittings Measure Instr.	Phys. & Mech. Systems Fluid Systems Electricity Arith. Applic.
Nursery Worker Admin. Assist. .56 Property Mgr. Retail Merchant	Arith. Comput. Arith. Applic. Clerical Verbal Comm. Number Facil. Verbal Compre. Express Fluency Sensitivity to Prob. Deductive Reason	Sales Deal w/Social Etiq. & Soc. Grace Social Intel.

NOTE: Primary = ++
Secondary = +

The RI group was characterized primarily by the attributes related to the use of concrete objects and materials. The ES cluster was most characterized by attributes related to cognitive and social skills.

A smaller grouping of two occupations included Auto Mechanic and Dairy Farmer and was characterized by attributes related primarily to objects and materials. The Plumber occupation evidenced relationships to some occupations in each of two clusters, but not to all jobs in those clusters. Arithematic Application on Arithematic Computation is found in all groups. The entire cluster represents an apparently meaningful set of relationships when viewed from the perspective of worker types and work environments and context.

Form B. The analysis of Form B ratings (Psychological Process) and resulting cluster are presented in Table 15.

Table 15

Job Relationship Cluster Based on Psychological Processes in Common

Form B

Cluster	Processes Shared by Groups ++	Processes Shared by Groups +
Merchant .50 Carpenter .67 Administrative Assistant Baker Property Manager Nursery Worker Plumber .67	Chaining	Rule Using Decision Making
Dairy Farmer .60 Auto Mechanic Auto Mechanic Printer .50 Auto Body .60 Machinist	Chaining	Discriminating Coding Tracking Problem Solving

NOTE: ++ Primary
+ Secondary

A high level of commonality was found between 26 of the 66 possible combinations of job pairs. The psychological process of "Chaining or Rote Sequencing" was common to all 12 jobs. This single classification category accounted for a major portion of measurable commonality between all 12 jobs. Two major groups of jobs were discriminated by six other processes. The processes of "Rule Using and Decision Making" were secondary descriptors of one major group including Baker, Administrative Assistant, Property Manager, Nursery Worker, Plumber, Merchant, and Carpenter.

The second major group was characterized by the process of "Discriminating, Coding, Tracking, and Problem Solving" as secondary descriptors. The jobs of Dairy Farmer, Auto Mechanic, Printer, Machinist, and Auto Body constituted a major group different from the first; however, they are to some extent, a fractured group.

Four occupations had single relationships to one of the jobs in the two major groups. Jobs with a unique relationship to a single job within a group are located on the periphery of the major groups. Merchant, Carpenter, Auto Mechanic, Machinist, and Auto Body have such a relationship.

Form C. The data from Form C (Content Domains) provided ratings which lacked sufficient discrimination to construct any meaningful cluster. There were, however, two major groups of occupations which were aligned in the following manner. The RI occupations of Baker, Printer, Auto Body, Carpenter, Plumber, Auto Mechanic, Dairy Farmer, and Machinist were characterized primarily by a high relationship to the Mechanical content domain. The remaining four occupations of Nursery Worker (an RI type) and Administrative Assistant, Property Manager, and Merchant (ES types) were primarily related to the Symbolic content domain.

Form D. The job relationships indicated by the responses to Form D (Action Processes) were analyzed. A major difference was found between Form D data and that of Forms A and B. The number of tasks on which there was rater agreement was significantly less on Form D than on Forms A or B. Therefore, measures of commonality are based on less frequent incidents of consensus between raters, increasing the probability of chance relationships. A second difference, other than low numbers of task consensus, was the manner in which the responses were distributed across classification categories. The major portion of rater responses on all jobs accumulated on the last one third of the categories, including category numbers 13 through 19. An examination of the degree of commonality provided values that yielded the clusters shown in Table 16.

The action processes that characterized the jobs are listed to the right of the cluster. Two groups of processes divide the jobs into two general *sets,* labeled A and B. The jobs of Auto Mechanic, Auto Body, and Dairy Farmer, in Set A, are characterized by 10 processes, of which Code is unique to this set. The remaining eight jobs are characterized by 13 of the processes, five of which are unique to set B.

Nursery Worker, Baker, Property Manager, and Administrative Assistant constituted the only cluster containing multiple jobs.

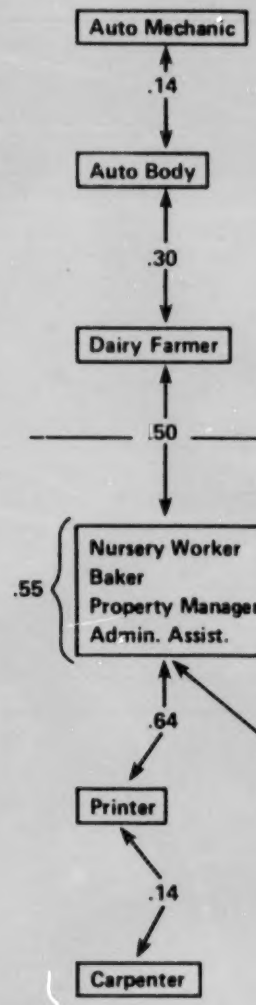
Form E. A review of the data from Form E (Data-People-Things) revealed a similar polarization of jobs as found on Form C, Content Domains. The three ES type jobs and Nursery Worker were characterized by a primary relationship to Data. Property Manager carried a high consensus of ratings (10 or more tasks) on People and Things while Nursery Worker was also rated high on Things.

The remaining jobs were primarily characterized by high ratings on Things, with Baker and Plumber also rated high on Data. Dairy Farmer received a high rating on the People category (which

Table 16

Job Relationship Cluster Based on
Action Processes in Common

Form D

Cluster	Processes Shared by Groups	
	Queue to Channel Search *Code Transmit Compute Plan Test Control Edit	Set A
	Queue to Channel Search Transmit *Store Compute *Count *Decide/Select Plan Test Control Edit *Adapt/Learn	Set B

NOTE: * = Process unique to the set of occupational clusters.

includes involvement with animals). A cluster diagram was not developed for Form E because the data only provided commonality values of either 33, 50, 66, or 100 percent, which did not discriminate meaningfully between the job pairs.

Summary. Considerable similarity was found between the clusters produced by Forms A and B. In both clusters the occupations of Administrative Assistant, Property Manager, and Nursery Worker were grouped together. Also Dairy Farmer and Auto Mechanic constituted a close pair. A third incident of consistent commonality was found among the jobs of Plumber, Printer, Machinist, and Auto Body Repairer.

The job group associated by Form D data included the same four jobs as the Form B cluster and three of the same jobs contained in one of the Form A groups. Nursery Worker consistently aligned with Administrative Assistant, Property Manager, and Retail Merchant.

The RI groups tended to be more like each other, with the exception of Group 4, which tended to be more like the ES group. The relationship between Groups 4 and 5 appears to be attributed to their high Data orientation. The RI groups 1, 2 and 3 appear to be polarized by their relationship to Things.

Utility of Classifications for Job Comparisons

One further examination was made between the results of this and a German study Hofbauer & König, 1972) in which the strength of inter-occupational relationships was measured on the basis of supervisors' judgments. The relationships identified by Hofbauer and König were compared to the relationships indicated by each of the five classification schemes for comparable occupations in this study. The data indicating the degree of category commonality between occupations were used in testing for similar findings in the German study. Seven occupations were available for comparison between the two studies. The directional relationship (movement from the first stated occupation to the second) between occupation groups reported in the German study are presented in Table 17 with the data from the task classification approach that indicated similar results.

Table 17

Comparison of Findings Supporting Occupational Relationships

Hofbauer & König Data		Classification Scheme Data	
Occupational Pairs	Degree	Form	Degree
Machinist → Auto Body Repairer	High	A, E	High
Auto Body Repairer → Machinist	Low		None
Machinist → Plumber	Moderate	A	Moderate
Machinist → Auto Mechanic	Low	C E	Moderate High

The occupations of Baker, Retail Merchant, and Carpenter had less than a 10% mobility rate to the other occupations in the Hofbauer and Konig study. However, the data from the classification scheme approach indicated a number of relationships involving these three occupations. The degree of relationship between occupational pairs receiving support on two or more classification schemes are presented in Table 18.

Table 18

Degree of Commonality Between Occupational Pairs Based on Classification Approach

Occupational Pairs			Forms	Degree
Baker	–	Auto Body Repairer	C	Moderate
			D	Low
Baker	–	Carpenter	B	High
			E	High
Baker	–	Plumber	B	Moderate
			C	Moderate
			D	Moderate
			E	High
Auto Body	–	Carpenter	A	Moderate
			C	High
Auto Body	–	Plumber	A	Low
			C	Moderate
Carpenter	–	Plumber	A	Moderate
			C	High
			E	High
Carpenter	–	Machinist	A	Moderate
			C	High

The pattern of the findings in both studies, while not overwhelmingly so, appear to be similar. The indicated commonalities between job pairs were more numerous for the classification scheme approach than for the supervisor judgment technique. A cautious and tentative inference might be drawn, that the classification scheme approach is at least as effective as supervisor judgment, and perhaps more sensitive in identifying the existence of job relationships.

Task Ratings Compared to Job Ratings

An additional exploration was conducted to compare results from the task and job ratings procedures. The four jobs of Printer, Dairy Farmer, Machinist, and Administrative Assistant were selected from the 12 jobs used in the study. These jobs represent three of the five occupational groupings studied. The jobs and groups they represent are illustrated on the next page.

	A Priori Job Grouping	
	Holland SDS Codes	Data-People-Things Relationship
Printer	Realistic-Investigative	Things
Dairy Farmer	Realistic-Investigative	Data-Things
Machinist	Realistic-Investigative	Data-Things
Administrative Assistant	Enterprising-Social	Data

Classification scheme ratings, based on the whole job, were collected from three raters for each job. The same attribute, process, content domain, action, and object categories used in the task rating process were used in the job rating approach. However, the raters expressed their judgments by indicating, on a seven-point interval scale, the degree to which each classification category is a requirement of the job. Each respondent indicated only one response to each category of each classification scheme, resulting in a total of 86 ratings per respondent. The three scores provided by the raters for each category were averaged.

For the purpose of comparison the average scores were translated into No, Low, Medium or High rating according to the following scheme.

Average Rating Per Category	Code
Below 2.7	No
2.7 to 3.9	Low
4.0 to 4.9	Medium
5.0 and above	High

Recall that the number of *tasks* requiring a category, as determined by the task rating approach, can also be translated into No, Low, Medium or High ratings according to the following scheme (see section on Measures of Job Relationships).

Task Rating	Code
0 tasks	No
1-4 tasks	Low
5-9 tasks	Medium
10 or more tasks	High

By translating the absolute task ratings and the relative job ratings into the No, Low, Medium, and High codes we were able to make a comparison of the relative amount of agreement between the

task rating and *job rating* approaches. We recognize that this procedure is at best an approximate comparison and caution should be exercised in drawing conclusions regarding the results.

However, this procedure provided a mechanism for determining both the numbers and percentage of agreement between the two approaches as shown in Table 19.

Table 19

Percent of Matched Ratings Between
Task and Job Rating Procedures

(and showing number of rating categories in agreement)

Classification Scheme	Rating	Occupation			
		Printer	Dairy Farmer	Machinist	Admin. Asst.
		55%	55%	64%	81%
A	High	3	7	6	10
42 Attributes	Medium	2	3	1	6
	Low	2	2	1	4
	No	16	11	19	14
		25%	50%	25%	25%
B	High	1	1	0	1
12 Processes	Medium	1	1	1	0
	Low	0	3	0	2
	No	1	1	2	0
		67%	67%	67%	83%
C	High	1	1	1	1
6 Domains	Medium	1	2	0	1
	Low	0	0	0	0
	No	2	1	3	3
		30%	30%	26%	48%
D	High	1	0	0	0
23 Actions	Medium	2	3	0	2
	Low	3	2	1	9
	No	1	2	5	0
		67%	100%	67%	100%
E	High	1	2	1	2
3 Object Types	Medium	1	1	0	1
	Medium	0	0	1	0
	No	0	0	0	0

The number of matched ratings on Form A (Human Attributes) were highest on Administrative Assistant with 34 out of 42 matched, for a rating agreement of 81%. Machinist was next highest with 27 out of 42 for 64% agreement. Printer and Dairy Farmer were lowest with 23 out of 42 for 55% agreement.

The Form B ratings (Psychological Processes) produced the following results. Dairy Farmer, 6 out of 12 for 50%; Administrative Assistant, Printer, and Machinist at 3 out of 12 for 25% agreement.

The percentages for Form C (Content Domains) were reasonably high, at 83% for Administrative Assistant, and 67% for Printer, Dairy Farmer, and Machinist. The increased agreement obtained with this rating form was to be expected because the number of categories was small.

The Form D ratings (Action Processes) resulted in agreement measures of 48% for Administrative Assistant, 30% for Printer and Dairy Farmer, and 26% for Machinist.

Raters responding to the job rating instruments were provided the opportunity to rate every category of the five schemes. However, the average rating for some of the categories were well below the scale midpoint of the 4.0 level. A comparison was made of (a) the number of attributes rated at 4.0 or above on the job rating approach with (b) the number of categories receiving a consensus of at least three raters on the task rating approach. The total number of categories thus rated as required for the occupation by each approach are presented in Table 20.

Table 20

Comparison of Numbers of Categories Required by Task and Job Rating Approaches

Occupation	Classification Scheme									
	A (42)		B (12)		C (6)		D (23)		E (3)	
	Task	Job	Task	Job	Task	Job	Task	Job	Task	Job
Printer	13	14	5	4	2	2	7	14	2	2
Dairy Farmer	11	19	5	11	3	3	6	19	3	3
Machinist	10	11	3	2	2	1	5	7	2	2
Administrative Assistant	18	23	3	12	3	2	11	23	3	3

NOTE: Numbers in parentheses indicate total number of categories on each form.

The numbers of categories selected were similar for Forms A, C, and E. However, Forms B and D were considerably different, with almost twice as many categories selected by the job rating procedure as by the task rating approach. The result of this difference was an increase in the number of categories on which a match was obtained between procedures. For Administrative Assistant all categories on Forms B and D were rated 4.0 or above by the job rating approach, resulting in a match with every category selected by the task approach. Therefore, while the percentage of agreements were somewhat higher for Administrative Assistant, they were due primarily to the lack of discrimination between categories by the job rating approach.

In general, moderate to high levels of agreement between the two approaches were obtained. Though the job rating procedure required less time, the raters tended to rate all or most categories of some schemes as highly related. It would appear that the task rating approach is more precise in discriminating between the various attributes required or related to an occupation.

IMPLICATIONS

Limitations of Design and Application

Among the acknowledged limitations of the design and application of this effort are:

1. Very general classification of *objects* acted upon and of *information input* used in Forms C and E.

2. No classification of *contexts* for skill application.

3. Uncertain utility of the separate use of the classifications for each element of a task, as compared to a possible combined use of the classifications.

4. Uncertainty of the relative job significance among task statements used for each occupation.

5. Other classification schemes for task elements or for skill types may be more useful.

6. Complex definitions of categories for a number of the classification schemes, particularly Forms B and D.

7. Selection of occupations was deliberately limited, and does not reflect professional, medical, and technical occupations requiring very large amounts of training.

8. Use of project staff and others not fully knowledgeable of occupations as classification raters.

9. Use of only five judges per task classification scheme for each occupation.

10. Use of a limited set (50) of tasks for each occupation.

11. Nonavailability of task inventories representing occupations in a career progression.

12. Degree or extent of skill development, durability, or persistence were not considered.

A basic question remains as to which one or combination of schemes are effective in, or provide the most useful insights for, assessing or identifying skills which are transferable among certain types of work settings or between various occupational pairs. Many classification schemes exist for analyzing occupations and workers (Ashley, 1977).

The limitations noted above should not detract from the results of this exploratory study. This effort was intended as an initial and brief examination of the feasibility of using task ratings to identify skill relationships among jobs. There were obvious limitations, but it is our hope that by reporting this study, future studies may be planned more effectively.

Conclusions

Firm conclusions fully substantiated by the empirical results and study design were not intended from this study. This was only an initial foray to begin exploring the merit and feasibility of task

classifications as a basis for understanding transferable skills. It is possible, however, to suggest tentative conclusions, along with impressions gained through the experience of conducting this study. Such conclusions and impressions are reported here.

It is apparent that tasks can be individually classified, that at least some classification schemes produce reasonable rater agreement for a wide assortment of types of tasks, and that such classifications can identify differential task characteristics. However, there is cause for hesitancy in suggesting further study in more depth and sophistication, due to the conceptually complex and tedious chore for persons asked to rate occupational tasks. The rating assignment was both laborious and difficult (as attested by almost unanious comments from the raters used in this study).

Additionally, to achieve greater comprehensiveness, discrimination, and reliability by the classification schemes employed here, even more raters would be necessary for each occupation studied. This would require a very determined and imaginative effort.

Yet there would seem to be real value in being able to specify the nature of occupational similarities in underlying skill requirements. Task classification seemingly is one way of attaining that goal.

Of the classification schemes as used here, the Human Attributes (Form A) provided the greatest usefulness in enabling meaningful clusters of related occupations to be generated. Most of the 42 attribute categories of that scheme received a high degree of use, and that use was such as to produce many points of rater agreement for each occupation. When pairs of occupation were compared with respect to characteristic attributes, again most of the attribute categories were brought into play. It seemed that a different set of occupations could readily bring all of the attributes into use as points of occupational similarity.

In the present study, nearly every one of the 600 tasks had at least two required attributes, as rated on Form A by three or more of the five raters per task. As with jobs as a whole, some tasks have requirements for multiple categories within a classification scheme. Even with the three-category scheme of Data-People-Things objects of action (Form E), raters often expressed a need to use more than one category to characterize a task.

While the attributes of Form A appear the most useful in generating occupational clusters and in identifying specific points of relationship between jobs, that system also required about four times as long to complete the ratings as did the next lengthiest classification form (Form B or D). It seems possible that the results from use of Form B (Psychological Processes) and Form D (Action Processes) could be improved by (a) clarifying and simplifying their category definitions and by (b) permiting raters to choose more than one category per task.

In regard to measures of similarity between pairs of occupations, there appears some interesting differences achieved by use of the Σd^2 statistic on task tally sums, as opposed to the measure of percent of classification categories held in common. The Σd^2 of category rating frequencies seems to yield a measure of relation that reflects the whole job. There often was a high usage of certain classification categories, even though little rater agreement was achieved for those categories on specific tasks. For instance, on Form A (Human Attributes) this occasionally occurred for attributes of Materials, Visualization, Sensitivity to Problems, and Memory. It could be hypothesized that these attributes reflect general characteristics of the job, even though they cannot be attributed to any one particular task.

On the other hand, the "percent in common" measure requires some agreement among raters, and is less influenced by high usage of one classification category by a single rater. It therefore would reflect more stable job profiles.

Future Studies

Some ideas for further research are suggested here for the benefit of others who may wish to pursue in more detail and substance the idea of classifying occupational tasks as a means of identifying transferable skills. Given some belief in the general merit and feasibility of the task classification approach, there would appear to be a number of research issues that warrant serious study.

Several testable hypotheses appear meaningful:

1. An individual's potential for occupational transfer increases as a function of the number of categories (of a classification scheme) in which task skills have been developed, and even greater transfer potential would result if such task skills are learned for transfer.

2. After learning (developing) a skill in one context, such as in the performance of one task, additional training practice in using (applying) that skill in other contexts enhances its potential for transfer. This assumes that transfer effect is measured by reduced time to learn the new application and to perform it effectively.

3. Skills underlying a task in which performance proficiency has been developed have greater potential for transfer to the learning of other tasks having the same classification than to the learning of tasks having a different classification.

If this latter hypothesis were true, it could become possible also to classify nonoccupational life performance activities (such as occur in housekeeping, family living, civic participation, hobby, craft, sports) in which an individual has developed some proficiency. These classifications might then be related to occupational requirements similarly classified, one means of providing useful career guidance. The potential here is for a youth, homemaker, or displaced worker to make efficient occupational use of skills that have already been developed.

Additional questions for study arise out of the limitations acknowledged in the present exploratory study:

1. Would more useful classification profiles result if worker-oriented task statements were rated, instead of the job-oriented task statements that were used?

2. Would more useful distributions of occupational skill characteristics result from use of Forms B (Psychological Processes), C (Content Domains), D (Action Processes), and E (Objects of Actions) if raters were allowed to indicate multiple categories of classification for tasks, as was done on Form A (Human Attributes)?

3. Can a meaningful and useful classification scheme be developed for rating Contexts of Task Performance?

4. Are there other elements of task statements, or combinations of elements, that would be worth classifying?

5. Are there feasible ways of rating the level or extent of skill developed, along with the task classification?

6. Is the classifying of the elements of task statements (i.e., input, action, object, context) a useful method for identifying underlying task skills, or is it better to generate skill classifications directly from the task statement as a whole unit of activity?

7. Would more useful classification profiles result if task ratings were weighted by the job significance or performance frequency of each task?

Quite obviously, the feasibility and utility of applying other task classification schemes could be investigated, using each of the four conceptual bases outlined by Fleishman (1975):

1. Behavior description approach, using worker-oriented variables.

2. Behavior requirements approach, describing the behavioral or functional processes that intervene to enable a worker to achieve task proficiency.

3. Ability requirements approach, describing tasks in terms of the abilities required of the worker.

4. Task characteristics approach, describing properties or characteristics of various task components.

As one means of assessing the merit of job relationships established by a particular classification scheme, it might be useful to compare relationships identified (a) for occupations representing a career progression, (b) with those of lateral occupations not in the career progression, and (c) with those of apparently unrelated occupations.

There is also a need to test out the generalizability (transferability) of skills inherent within one type of task cluster, particularly as such skills may usefully transfer across different occupations to tasks of the same type.

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APPENDIX A

Special Performance Contexts for Tasks

INSTRUCTIONS: Indicate which, if any, of the context categories are most descriptive of the job situation or conditions under which each task typically is performed. These should be the most distinctive ones for each task *as the worker senses them,* and indicating the significant qualities of the job context that influence performance of that task.

Physical Factors

1. *Exposure to physical hazards,* such as dangerous operating machinery, moving or falling objects, toxic conditions, slippery or unstable platforms, high places, electrical shock.

2. *Presence of physical disturbances or distractions,* such as vibration, noise intensity, sudden or fluctuating temperature changes.

3. *Presence of unpleasant or trying physical conditions,* such as controlled temperature extremes, excessive moisture or humidity, dirt/grease/dust, general noise and light extremes, offensive odors, close quarters for working.

4. *Presence of unpleasant or trying weather conditions,* such as storms (sand, rain, snow), icy or muddy roads or equipment, blowing dust or dirt, very hot or cold temperatures.

5. *Performance difficulty due to special attire or obstructions,* such as awkward or bulky protective clothing, gloves, goggles, masks, headsets, weighted shoes.

Organizational and Work Structure Factors

6. *Presence of disturbances or distractions due to work interruptions or variations in time available.*

7. *Pressure of performance time, accuracy, or cost effectiveness standards and constraints.*

8. *Restrictions of structured or constrained processes,* such as specified operating procedures, codified work rules, close supervision.

9. *Procedural difficulty due to insufficient or unstructured rules, directives, management decisions.*

10. *Procedural difficulty due to inadequate or improper equipment, tools, or material.*

Psycho-Social Factors

11. *Presence of unpleasant or trying interpersonal situations,* such as interpersonal conflict, unpleasant social relationships.

12. *Dealing with uncertainty,* such as incomplete information, partial malfunctions, conflict of rules.

13. *Stresses due to danger, fatigue, emergency.*

14. *Emphasis on cooperation and involvement with others,* such as teamwork, assistance, work in presence of others, supervision of others.

15. *Pressure of a considerable amount of responsibility,* such as for financial or material consequences of errors, goal achievement, skill development and updating, awareness of events and conditions.

Many of these categories were derived from the Dimensions of Work Context reported by J. A. Riccobono and J. W. Cunningham, *Work dimensions derived through systematic job analysis: A replicated study of the Occupational Analysis Inventory* (Ergometric R&D Series Rep. No. 6, Center Res. Mono. No. 9). Raleigh: North Carolina State University at Raleigh, Center for Occupational Education, 1971.

APPENDIX B

Questionnaire for Form A

Contents:

1. Procedural instructions to raters on task questionnaires.
2. Occupational listing of tasks to be rated. (for one sample occupation)
3. Response sheets for Form A task ratings. (reduced size, first page only)
4. Definitions of attribute categories. (reduced size)

INSTRUCTIONS

General Information

This package contains three separate rating forms labelled in the upper left corner, as A, B, and C. Also enclosed is a Background Information form and a return envelope. Complete the Background Information form.

- Each task rating form uses a different rating system to rate the same fifty task statements.
- The task statements to be used with Form A are attached to the front of the form. Each numbered task statement corresponds to the number at the top of each column of boxes, beginning on page one and ending on page five of the rating form.
- The last page of each form presents explanations and definitions of the terms for the particular rating system used with each form.
- After you have completed the forms, place them along with the Background Information form in the return envelope and mail it to The Center. In some locations I will return to pick up your materials and will notify you in advance.

If you have any questions or problems with the instructions or the forms, please call me (collect) at:

Bill Ashley
The Center for Vocational Education
Columbus, Ohio
(614) 486-3655, Ext. 282

Procedures

Look over each rating form to familiarize yourself with the format and rating system.

Detach the explanation sheet (last page) for easy reference.

A response on any of the three forms will be made by writing in the proper *code number;* placing a check mark; or drawing a circle. You *do not* need to write in any terms.

Form A:

1. Read the first task statement on the attached list. (The list may be detached for convenience.)

2. Select each ability area (printed on the left margin) that, if lacking, would inhibit a worker from adequately performing the task. (Select not more than ten for each task.)

3. Place a check in each box in *Column 1* to indicate your rating of *Task 1.*

4. Repeat the same procedure for Task Statement 2 and so on.

Form B:

1. Read the first task statement and select the one Psychological Process which best describes the primary skill a worker uses to perform that task. Write the code number for the process on the blank line to the right of the task statement.

2. Next, move to the second column and circle one of the Content Domain codes to indicate the primary area of content knowledge and activity.

3. Repeat the procedure for each remaining task statement.

Form C:

1. Read the first task statement and select the one Action Process which best describes the primary process a worker uses to perform that task. Write the code number for the process on the blank line to the right of the task statement.

2. Next, move to the second column and circle one of the codes to indicate the type of item acted upon in the task.

3. Repeat the procedure for each remaining task statement.

PROPERTY MANAGER

1. Advise owner of benefits during initial planning of project.
2. Advise owner on rental market, costs, and ratios.
3. Analyze specific site locations for project.
4. Estimate operating income.
5. Purchase up-to-date maps of grounds and roads.
6. Order information sheets on local services.
7. Post record of tenant activities.
8. Develop vital statistics and profile of tenant.
9. Write publicity material.
10. Write advertising copy.
11. Compile statistics on school age children for local school board.
12. Determine size of needed personnel force.
13. Decide upon employee performance standards.
14. Interview a prospective employee.
15. Train an employee to show model apartments.
16. Write work schedules and time sheets.
17. Telephone for outside service.
18. Write a newsletter.
19. Enter changes in current and expected vacancies.
20. Write a prospective tenant list.
21. Contact prospective tenants when a vacancy arises.
22. Schedule sales presentations.
23. Furnish model apartment for show.
24. Telephone undecided prospect.

25. Direct an applicant in filling out forms.
26. Check credit rating on an applicant.
27. Prepare general lease agreement.
28. Describe service and tenant obligations.
29. Explain terms and meaning of covenants.
30. Receive deposit.
31. File lease and record expiration date.
32. Prepare rent expiration report for owner.
33. Inspect vacant apartment for needed repairs.
34. Schedule move-in of new tenants.
35. Schedule move-outs.
36. Inspect apartment for security refund and estimate cost of damages.
37. Deposit rent payments.
38. Follow-up delinquent tenants.
39. File tenant communications.
40. Report irregular paying tenants to owner.
41. Clean common area and clubroom.
42. Schedule social and recreation program.
43. Contract security guards.
44. Plan traffic and parking patterns.
45. Publish recreation area safety rules.
46. Post records of cash outlay.
47. Locate service people for tenant.
48. Inspect property and determine maitenance needs.
49. Inventory rental/loan equipment in storage.
50. Prepare monthly report.

IDENTIFYING HUMAN ATTRIBUTES REQUIRED TO PERFORM SELECT TASKS
(Neeb, Cunningham, & Pass, 1971)

Read each task statement and then check the ability areas that, if lacking, would inhibit a worker from adequately performing the task. CHECK ONE OR MORE, as necessary, but not more than 6 to 10 for a single task.

GENERAL VOCATIONAL CAPABILITIES		TASK NO. 1	2	3	4	5		6	7	8	9	10
Tools	1	☐	☐	☐	☐	☐	1	☐	☐	☐	☐	☐
Physical & Mechanical Systems	2	☐	☐	☐	☐	☐	2	☐	☐	☐	☐	☐
Stationary Machine and Equipment Operation	3	☐	☐	☐	☐	☐	3	☐	☐	☐	☐	☐
Vehicle Operation	4	☐	☐	☐	☐	☐	4	☐	☐	☐	☐	☐
Connections and Fittings	5	☐	☐	☐	☐	☐	5	☐	☐	☐	☐	☐
Fluid Systems	6	☐	☐	☐	☐	☐	6	☐	☐	☐	☐	☐
Measuring Instruments	7	☐	☐	☐	☐	☐	7	☐	☐	☐	☐	☐
Electricity	8	☐	☐	☐	☐	☐	8	☐	☐	☐	☐	☐
Layout and Visualization	9	☐	☐	☐	☐	☐	9	☐	☐	☐	☐	☐
Structures	10	☐	☐	☐	☐	☐	10	☐	☐	☐	☐	☐
Medical and First Aid	11	☐	☐	☐	☐	☐	11	☐	☐	☐	☐	☐
Materials	12	☐	☐	☐	☐	☐	12	☐	☐	☐	☐	☐
Chemicals	13	☐	☐	☐	☐	☐	13	☐	☐	☐	☐	☐
Foods and Cooking	14	☐	☐	☐	☐	☐	14	☐	☐	☐	☐	☐
Biological Systems	15	☐	☐	☐	☐	☐	15	☐	☐	☐	☐	☐
Arithmetic Computations	16	☐	☐	☐	☐	☐	16	☐	☐	☐	☐	☐
Arithmetic Applications	17	☐	☐	☐	☐	☐	17	☐	☐	☐	☐	☐
Clerical	18	☐	☐	☐	☐	☐	18	☐	☐	☐	☐	☐
Verbal Communication	19	☐	☐	☐	☐	☐	19	☐	☐	☐	☐	☐
Sales	20	☐	☐	☐	☐	☐	20	☐	☐	☐	☐	☐
Service	21	☐	☐	☐	☐	☐	21	☐	☐	☐	☐	☐
Dealing with Social Situations	22	☐	☐	☐	☐	☐	22	☐	☐	☐	☐	☐
Etiquette and Social Grace	23	☐	☐	☐	☐	☐	23	☐	☐	☐	☐	☐
Style and Grooming	24	☐	☐	☐	☐	☐	24	☐	☐	☐	☐	☐
COGNITIVE CAPACITIES												
Form Perception	25	☐	☐	☐	☐	☐	25	☐	☐	☐	☐	☐
Perceptual Speed	26	☐	☐	☐	☐	☐	26	☐	☐	☐	☐	☐
Spatial Scanning	27	☐	☐	☐	☐	☐	27	☐	☐	☐	☐	☐
Spatial Orientation	28	☐	☐	☐	☐	☐	28	☐	☐	☐	☐	☐
Visualization	29	☐	☐	☐	☐	☐	29	☐	☐	☐	☐	☐
Number Facility	30	☐	☐	☐	☐	☐	30	☐	☐	☐	☐	☐
Memory	31	☐	☐	☐	☐	☐	31	☐	☐	☐	☐	☐
Verbal Comprehension	32	☐	☐	☐	☐	☐	32	☐	☐	☐	☐	☐
Grammar	33	☐	☐	☐	☐	☐	33	☐	☐	☐	☐	☐
Spelling	34	☐	☐	☐	☐	☐	34	☐	☐	☐	☐	☐
Expressional Fluency	35	☐	☐	☐	☐	☐	35	☐	☐	☐	☐	☐
Ideational Fluency	36	☐	☐	☐	☐	☐	36	☐	☐	☐	☐	☐
Sensitivity to Problems	37	☐	☐	☐	☐	☐	37	☐	☐	☐	☐	☐
Deductive Reasoning	38	☐	☐	☐	☐	☐	38	☐	☐	☐	☐	☐
Originality	39	☐	☐	☐	☐	☐	39	☐	☐	☐	☐	☐
Social Intelligence	40	☐	☐	☐	☐	☐	40	☐	☐	☐	☐	☐
Aesthetic Judgment	41	☐	☐	☐	☐	☐	41	☐	☐	☐	☐	☐
Musical Talent	42	☐	☐	☐	☐	☐	42	☐	☐	☐	☐	☐
None of the Above	43	☐	☐	☐	☐	☐	43	☐	☐	☐	☐	☐

A

GENERAL VOCATIONAL CAPABILITIES (Based on Neeb, Cunningham, & Pass, 1971)

1. TOOLS – Use of common hand tools, portable power tools and equipment (electrical, gasoline, pneumatic, etc.) or selected special tools, including delicate precision tools.

2. PHYSICAL & MECHANICAL SYSTEMS – Knowledge of elementary mechanical and physical principles and mechanical components (pulleys, gears, fulcrums, inclined plane, levers, tension, compression, force, weight), and skill in applying these to tasks.

3. STATIONARY MACHINE AND EQUIPMENT OPERATIONS – Operating stationary equipment such as drill presses, lathes, book binding machines, meat slicers, sewing machines, etc. (but *not* including office machines such as typewriters).

4. VEHICLE OPERATION – Operating vehicles effectively, including knowledge of vehicular motion, operator maintenance, or relevant safety considerations.

5. CONNECTIONS AND FITTINGS – Use of threads, flanges, solder joints, zippers, welds, packing, washers, etc.

6. FLUID SYSTEMS – Understanding of leak detection measures; solid, liquid, and gas transforms; pressure; valves; safety devices; or thermostats.

7. MEASURING INSTRUMENTS – Competence in using measuring instruments including knowledge of units of measurment, tolerances, or principles of measurement and estimation.

8. ELECTRICITY – Knowledge of principles and concepts of electricity, electro-mechanics, or electronics.

9. LAYOUT AND VISUALIZATION – Doing layouts and drawings, including use of drawing tools, sealing and measuring instruments, clothing patterns, typewriter spacing and composing of format, labels and dimensions, or basic geometric principles.

10. STRUCTURES – Knowledge of accepted standards of structural design including such principles as maximum strength, use of building materials and insulation, maximum weather protection, or removal of damaged structures.

11. MEDICAL AND FIRST AID – Knowledge of medical and first aid practices and techniques and capacity to use this knowledge in treating injuries or illnesses.

12. MATERIALS – Knowledge of the characteristics, properties, or uses of common materials.

13. CHEMICALS – Knowledge of *common* chemicals, chemical components, or their reactions and effects.

14. FOODS AND COOKING – Knowledge of common foods; their preparation and composition; basic food chemistry; diets; or food sanitation.

15. BIOLOGICAL SYSTEMS – Knowledge of anatomy, physiology, or the functioning of life systems.

16. ARITHMETIC COMPUTATION – Carry out basic arithmetic operations (addition, subtraction, division, multiplication).

17. ARITHMETIC APPLICATIONS – Use arithmetic and bookkeeping conventions including rules and common practice for graphs, tables, charts, ledgers, service records, etc.

18. CLERICAL – Knowledge of office routines, letter format, copying, filing procedures, and basic office machine operation (for example, typewriters, adding machines, postage meters, calculators, etc.)

19. VERBAL COMMUNICATION – Oral and written expression and comprehension including the giving of effective instructions; writing letters or preparing reports; defending opinions; reading rapidly with high retention; understanding lectures and briefings; or speaking effectively.

20. SALES – Assessing customer's needs and then matching customer, product, and sales technique.

21. SERVICE – Knowledge of customer's or client's rights and needs, and the rules and procedures of effective service, including use of this knowledge to client's advantage and satisfaction.

A

GENERAL VOCATIONAL CAPABILITIES – Continued

22. DEALING WITH SOCIAL SITUATIONS – Perceiving social situations correctly and reacting appropriately.

23. ETIQUETTE AND SOCIAL GRACE – Knowledge of the social behavior, manners, and ceremonies established by convention as acceptable for the situation and the following of these rules in the work performance.

24. STYLE AND GROOMING – Knowledge of proper attire and grooming for the situation or activity.

25. FORM PERCEPTION – Perceive pertinent detail in objects or in pictorial or graphic material; make fine visual comparisons and discriminations among characteristics such as shapes and shadings of figures or objects and widths and lengths of lines.

26. PERCEPTUAL SPEED – Rapidly perceive pertinent detail in textual or tabular materials; rapidly perform simple visual discrimination tasks.

27. SPATIAL SCANNING – Visually explore a wide or complicated field with the objective of identifying or detecting objects.

28. SPATIAL ORIENTATION – Perceive spatial patterns; orient oneself in relation to the position and configuration of surrounding objects.

29. VISUALIZATION – Comprehend spatial patterns in two or three dimensions and mentally manipulate or transform them into other spatial patterns; visualize objects of two or three dimensions; think visually of geometric forms.

30. NUMBER FACILITY – Manipulate numbers in arithmetical operations (especially addition, subtraction, multiplication, and division) rapidly and accurately.

31. MEMORY – Mentally store pertinent information and recall it for use within a short period of time (one minute to eight hours).

32. VERBAL COMPREHENSION – Understand meanings of words and the ideas associated with them, and use them effectively.

33. GRAMMAR – Deal with forms and structures of words and their customary arrangement in phrases and sentences.

34. SPELLING – Use letters properly to form words; distinguish between correctly spelled and misspelled words.

35. EXPRESSIONAL FLUENCY – Rapidly put ideas into words, especially in oral or written communication.

36. IDEATIONAL FLUENCY – Rapidly form or entertain ideas or new impressions about a given topic (such as in committee planning meetings or in being confronted by challenging situations or clients).

37. SENSITIVITY TO PROBLEMS – Recognize practical problems, deficiences in courses of action or organizational plans, or implications of activities.

38. DEDUCTIVE REASONING – Take given premises or facts, and reach a conclusion that necessarily follows from such givens (such as, infer what consequences are likely to result if a particular course of action were to be followed). That is, having a set of facts, state a conclusion (such as a mechanic determining cause from symptoms).

39. ORIGINALITY – Produce responses or ideas which are either clever or uncommonly creative and imaginative.

40. SOCIAL INTELLIGENCE – Process and use behavioral information obtained through interaction with individual persons or groups.

41. AESTHETIC JUDGMENT – Make judgments concerning the compositional organization of objects on the basis of artistic variations in unity, proportion, form, color, perspective, and design.

42. MUSICAL TALENT – A combination of sensory, psychomotor, and cognitive capabilities which provide facility in musical endeavors (voice, instrument, composition, sensitivity).

43. NONE OF THE ABOVE.

APPENDIX C

Questionnaire for Forms B and C

Contents:

1. Occupational listing of tasks *and* response columns for Form B (Process) and Form C (Domain) task ratings. (reduced size, first page only, for one sample occupation)

2. Definitions of process and domain categories. (reduced size)

B

IDENTIFY PSYCHOLOGICAL PROCESSES AND CONTENT DOMAINS FOR SELECTED TASKS (Altman, 1966)

Occupation: Property Manager

DIRECTIONS: Read each Task Statement then select from the description sheet the Psychological Process which best describes the nature of what the worker does. Write the Code Number on the line following the task statement. If you are *most* uncertain of a process, check the box.

Circle *One* designation of the Content Domain involved in performing the task.

No.	Task Statement	Psychological Process Code	Uncertain	If uncertain, check box
1.	Advise owner of benefits during initial planning of project.	____	☐	M E S/S C/B S P ☐
2.	Advise owner on rental market, costs, and ratios.	____	☐	M E S/S C/B S P ☐
3.	Analyze specific site locations for project.	____	☐	M E S/S C/B S P ☐
4.	Estimate operating income.	____	☐	M E S/S C/B S P ☐
5.	Purchase up-to-date maps of grounds and roads.	____	☐	M E S/S C/B S P ☐
6.	Order information sheets on local services.	____	☐	M E S/S C/B S P ☐
7.	Post record of tenant activities.	____	☐	M E S/S C/B S P ☐
8.	Develop vital statistics and profile of tenant.	____	☐	M E S/S C/B S P ☐
9.	Write publicity material.	____	☐	M E S/S C/B S P ☐
10.	Write advertising copy.	____	☐	M E S/S C/B S P ☐
11.	Compile statistics on school age children for local school board.	____	☐	M E S/S C/B S P ☐
12.	Determine size of needed personnel force.	____	☐	M E S/S C/B S P ☐
13.	Decide upon employee performance standards.	____	☐	M E S/S C/B S P ☐
14.	Interview a prospective employee.	____	☐	M E S/S C/B S P ☐
15.	Train an employee to show model apartments.	____	☐	M E S/S C/B S P ☐
16.	Write work schedules and time sheets.	____	☐	M E S/S C/B S P ☐
17.	Telephone for outside service.	____	☐	M E S/S C/B S P ☐
18.	Write a newsletter.	____	☐	M E S/S C/B S P ☐
19.	Enter changes in current and expected vacancies.	____	☐	M E S/S C/B S P ☐
20.	Write a prospective tenant list.	____	☐	M E S/S C/B S P ☐

B

TYPES OF PSYCHOLOGICAL PROCESS
GENERAL VOCATIONAL CAPABILITIES (from Altman, 1966)

1. SENSING – Perceiving a difference in physical energies impinging on a single sense modality.

2. DETECTING – Perceiving the appearance of a target within a background field.

3. CHAINING OR ROTE SEQUENCING – Following a pre-specified order of verbal and/or motor acts in carrying out a procedure.

4. DISCRIMINATING OR IDENTIFYING – Perceiving the appearance of a given target as distinct from other similar targets. (Includes most association of nomenclature and locations with required job operations.)

5. CODING – Translating a perceived stimulus into another form, locus, or language. (Not necessarily involving the application of a sequence of logical rules.)

6. CLASSIFYING – Perceiving an object or target as representative of a particular class. (Where the objective characteristics of targets within the class may be widely dissimilar.)

7. ESTIMATING I (discrete case) – Perceiving distance, size, and/or rate without the application of measurement instruments, with discrete recording or responding (static estimation).

8. ESTIMATING II (or TRACKING) – Perceiving and reacting to a changing distance, size, and/or rate without the application of measurement instruments, with continuous responding (dynamic estimation).

9. LOGICAL MANIPULATION – Application of formal rules of logic and/or computation to an input as a basis for determining the appropriate output.

10. RULE USING – Executing a course of action, including one or more contingencies, by the application of a rule or principle.

11. DECISION MAKING – Choosing one out of a field of alternative actions in a probabilistic situation. (Including the following of optimum strategy in non-rote behavioral sequencing.)

12. PROBLEM SOLVING – Resolving courses of action where routine application of "rules" for "logical manipulation" and "decision making" would be inadequate for an optimum choice. (Seems to imply the integration and adaptation of existing principles into novel, specialized, or higher-order rules.)

13. NONE OF THESE.

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CONTENT DOMAINS

M MECHANICAL – Organized body of knowledge dealing with the operation, maintenance, or design of machines and mechanical systems. (Includes both stationary and vehicular mechanical systems, components, mechanical principles, fluid systems, tools, connections and fittings, measurement, and safety principles relating to mechanical devices.)

E ELECTRICAL – Encompassing the concepts and principles of electricity, electro-mechanics, and electronics. (Includes devices and functions, characteristics of components, symbols, safety, circuits, etc.)

S/S SPATIAL/STRUCTURAL – Application of geometric, numerical, and drawing techniques to structural design and representation. (Includes layout and visualization, analysis of structures in geometric terms, drawing instruments and standards, construction methods, uses for building materials, scaling and measuring.)

C/B CHEMICAL AND BIOLOGICAL – Application of concepts and principles of chemistry, biology, and physics to materials, chemical components and reactions, biological and medical systems, and to foods and cooking. (Includes principles of hygiene, chemical dangers, toxicity.)

S SYMBOLIC – Computational and symbolic manipulation skills involving either verbal or numerical components. (Includes arithmetic operations and symbol systems, bookkeeping conventions, spoken and written language, clerical skills associated with the production/processing/storage of written communications and records, giving and taking of instructions, preparation and presentation of reports.)

P PEOPLE – Aspects of human interaction and relations involved in behavior on the job, dealing with emergencies and social situations, sales, and service. (Includes behavior relating to style/grooming/etiquette/job conventions, ethical/legal/social criteria governing behavior in emergencies and other non-routine situations, persuasive interactions with or between workers or clients, supervision and subordinate behavior.)

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APPENDIX D

Questionnaire for Forms D and E

Contents:

1. Occupational listing of tasks *and* response columns for Form D (Actions) and Form E (Objects) task ratings. (reduced size, first page only, for one sample occupation)

2. Definitions of action and object categories. (reduced size)

C

IDENTIFYING WORKER ACTIONS AND ITEMS ACTED UPON SELECTED TASKS

DIRECTIONS: Read each Task Statement then select the Action Process which best describes the nature of what the worker does. Write the Code Number on the line following the Task Statement. If you are *most* uncertain of a process, check the box.

No.	Task Statement	Action Process Code	Uncertain
1.	Advise owner of benefits during initial planning of project.	____	☐
2.	Advise owner on rental market, costs, and ratios.	____	☐
3.	Analyze specific site locations for project.	____	☐
4.	Estimate operating income.	____	☐
5.	Purchase up-to-date maps of grounds and roads.	____	☐
6.	Order information sheets on local services.	____	☐
7.	Post record of tenant activities.	____	☐
8.	Develop vital statistics and profile of tenant.	____	☐
9.	Write publicity material.	____	☐
10.	Write advertising copy.	____	☐
11.	Compile statistics on school age children for local school board.	____	☐
12.	Determine size of needed personnel force.	____	☐
13.	Decide upon employee performance standards.	____	☐
14.	Interview a prospective employee.	____	☐
15.	Train an employee to show model apartments.	____	☐
16.	Write work schedules and time sheets.	____	☐
17.	Telephone for outside service.	____	☐
18.	Write a newsletter.	____	☐
19.	Enter changes in current and expected vacancies.	____	☐
20.	Write a prospective tenant list.	____	☐

Occupation: Property Manager

Circle *One* designation of the object or type of item acted upon in each task.

			If uncertain, check box
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐
D	P	T	☐

C

ACTION PROCESSES (from Miller, 1974)

1. INPUT SELECT – Selecting what to pay attention to next.
2. FILTER – Screening out what does not matter.
3. QUEUE TO CHANNEL – Lining up to get through the gate. (Sequencing, organizing, or prioritizing things to be attended to.)
4. DETECT – Is something there?
5. SEARCH – Looking for something. (Where the object of the search is known.)
6. IDENTIFY – What is it and what is its name? (Recognize and apply a label to an object or entity; diagnose.)
7. CODE – Translating the same information from one form to another.
8. INTERPRET – What does it mean? (Including pattern recognition.)
9. CATEGORIZE – Defining and naming a group of things.
10. TRANSMIT – Moving something from one place to another.
11. STORE – Keeping something intact for future use. (Includes retrieval search, long-term memory.)
12. SHORT-TERM MEMORY – Holding something temporarily.
13. COMPUTE – Figuring out a logical or mathematical answer to a defined problem.
14. COUNT – Keeping track of how many.
15. DECIDE/SELECT – Choosing an available response to fit a situation.
16. PLAN – Matching resources over time to expectations of needs. (Predicting possible future conditions and identifying what responses to make to them.)
17. TEST – Is it what it should be? (Sensing, comparing, and deciding.)
18. CONTROL – Changing an action according to plan. (Includes equipment operation or repair, physical or symbolic control, behavior direction and guidance of a transient nature.)
19. EDIT – Arranging, correcting, or converting things according to rule.
20. ADAPT/LEARN – Making and remembering new responses to a repeated situation. (Relatively permanent changes in quality or quantity of performance.)
21. DISPLAY – Showing something that makes sense. (Arranging, formating, patterning, or structuring for human perception and interpretation.)
22. PURGE – Getting rid of the dead stuff. (Eliminate the unwanted, erase, turn off, forget.)
23. RESET – Getting ready for some different action. (Conclude the prior and shift set for the next.)
24. NONE OF THESE.

D-P-T OBJECTS OF AN ACTION PROCESS (from U.S. Department of Labor, 1965)

D DATA – Information in some form, knowledge, conceptions, numbers, words, symbols, ideas, and oral verbalizations (resulting from observation, investigation, interpretation, visualization, and mental creation).

P PEOPLE – Human beings; also animals and other living creatures.

T THINGS – Inanimate objects as distinguished from human beings and animals: tangible substances or materials, machines, tools, equipment, and products.

APPENDIX E

Σd^2 Measures of Task Relationship Between Occupations

Form A: 42 Human Attributes

Form B: 12 Psychological Processes

Form C: 6 Content Domains

Form D: 23 Action Processes

Form E: 3 Objects of Action

Form A (Attributes)

	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nurseryworker	Admin. Assistant	Property Manager	Merchant
Baker		2989	1830	5164	2973	3796	1492	3473	1263	2398	1191	2277
Printer			2428	5171	3760	3683	2763	2018	2800	4533	3430	4462
Auto Body				2584	1150	1581	944	2453	1119	3512	2291	3407
Carpenter					3021	2182	3028	3189	3441	6888	5737	6523
Plumber						1459	1475	3480	2028	4233	3218	4186
Auto Mechanic							1588	3125	2533	4830	4289	5303
Dairy Farmer								2537	945	3166	1837	2761
Machinist									2754	4655	3854	4438
Nurseryworker										1475	567	1005
Admin. Assistant											846	1306
Property Manager												912
Merchant												

Form B (Processes)

	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nurseryworker	Admin. Assistant	Property Manager	Merchant
Baker		208	69	314	15	74	751	671	75	413	397	67
Printer			337	50	127	318	243	151	81	67	51	35
Auto Body				503	1868	19	1064	904	148	236	580	216
Carpenter					227	474	107	85	111	17	25	97
Plumber						83	606	780	38	298	282	52
Auto Mechanic							1165	47	141	601	551	195
Dairy Farmer								44	428	68	106	370
Machinist									332	38	46	278
Nurseryworker										172	146	16
Admin. Assistant											10	130
Property Manager												114
Merchant												

Form C (Content Domains)

	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nurseryworker	Admin. Assistant	Property Manager	Merchant
Baker		1336	1120	768	1347	2095	547	2379	298	1773	1260	1302
Printer			54	738	31	144	371	225	757	2343	2090	2114
Auto Body				654	61	198	203	237	691	2595	2318	2354
Carpenter					625	1338	791	1379	601	2031	1680	1846
Plumber						151	324	218	776	2330	2077	2092
Auto Mechanic							707	33	1406	3279	2602	3050
Dairy Farmer								790	547	2396	2113	2143
Machinist									1719	3834	3535	3573
Nurseryworker										931	660	708
Admin. Assistant											51	29
Property Manager												6
Merchant												

Form D (Actions)

	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nurseryworker	Admin. Assistant	Property Manager	Merchant
Baker		480	314	34	30	158	57	1124	49	22	24	37
Printer			339	516	506	665	405	181	389	476	452	524
Auto Body				305	323	424	218	793	244	241	313	321
Carpenter					24	145	45	1162	41	44	56	52
Plumber						175	61	1172	41	42	50	40
Auto Mechanic							116	1259	166	167	153	57
Dairy Farmer								981	40	59	71	49
Machinist									995	1117	1078	1210
Nurseryworker										45	59	53
Admin. Assistant											24	40
Property Manager												36
Merchant												

Form E (Objects)

	Baker	Printer	Auto Body	Carpenter	Plumber	Auto Mechanic	Dairy Farmer	Machinist	Nurseryworker	Admin. Assistant	Property Manager	Merchant
Baker		68	152	56	2	122	170	266	66	1360	1046	1195
Printer			36	20	54	26	314	90	234	1940	1598	1771
Auto Body				32	126	2	494	18	402	2360	1994	2331
Carpenter					38	18	374	98	242	1848	1554	999
Plumber						98	206	234	90	1417	1118	1261
Auto Mechanic							458	32	356	2216	1878	2053
Dairy Farmer								626	62	1322	808	1053
Machinist									564	2786	2366	2581
Nurseryworker										986	642	801
Admin. Assistant											134	35
Property Manager												33
Merchant												

APPENDIX F

Occupational Distributions of Classification Ratings and Number of Task Agreements

Form A: Human Attributes

Form B: Psychological Processes

Form C: Content Domains

Form D: Action Processes

Form E: Objects of Action

NOTE: Column headings abbreviated as *N* and *Tasks:*

N = Number of ratings across all 50 tasks among five raters.

Tasks = Number of tasks on which at least three raters agreed on classification category.

Form A: Human Attributes	Baker		Printer		Auto Body		Carpenter	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks
1. Tools	41	2	77	8	156	34	234	49
2. Phys. & Mech. Systems	5	1	143	33	54	7	67	0
3. Stationary Mach. & Eqpt. Operations	32	1	121	29	16	2	1	0
4. Vehicle Operation	0	0	7	0	10	0	2	0
5. Connections & Fittings	1	0	18	0	41	0	17	0
6. Fluid Systems	3	0	36	3	11	1	1	0
7. Measuring Instruments	17	2	65	9	29	2	172	42
8. Electricity	0	0	18	1	10	1	0	0
9. Layout & Visualization	8	0	70	12	19	1	122	24
10. Structures	1	0	5	0	63	8	65	6
11. Medical & First Aid	5	1	6	0	0	0	0	0
12. Materials	13	0	104	16	60	8	80	4
13. Chemicals	18	3	64	9	39	7	0	0
14. Foods & Cooking	116	23	0	0	0	0	0	0
15. Biological Systems	2	0	0	0	0	0	0	0
16. Arithmetic Computation	21	2	22	4	8	1	90	9
17. Arithmetic Applications	29	3	49	5	19	1	74	6
18. Clerical	15	2	17	1	10	2	0	0
19. Verbal Communication	18	3	21	1	18	1	9	0
20. Sales	20	0	2	0	2	0	0	0
21. Service	8	1	1	0	1	0	0	0
22. Dealing with Social Situations	11	1	5	0	1	0	0	0
23. Etiquette & Social Grace	5	0	0	0	0	0	0	0
24. Style & Grooming	4	0	0	0	0	0	0	0
25. Form Perception	10	0	35	3	32	2	35	0
26. Perceptual Speed	4	0	16	0	25	0	0	0
27. Spatial Scanning	3	0	44	2	16	1	6	0
28. Spatial Orientation	9	0	22	0	6	0	21	0
29. Visualization	16	0	65	7	39	5	70	7
30. Number Facility	14	2	23	0	7	0	51	0
31. Memory	13	0	45	2	35	1	18	0
32. Verbal Comprehension	13	2	7	0	17	0	4	0
33. Grammar	5	0	5	1	6	0	0	0
34. Spelling	9	3	6	1	7	0	0	0
35. Expressional Fluency	10	2	13	0	3	0	0	0
36. Ideational Fluency	4	0	10	0	0	0	0	0
37. Sensitivity to Problems	22	2	15	0	34	0	37	0
38. Deductive Reasoning	17	2	25	0	35	1	3	0
39. Originality	16	3	3	0	1	0	0	0
40. Social Intelligence	10	1	3	0	1	0	0	0
41. Aesthetic Judgment	33	5	29	3	9	1	1	0
42. Musical Talent	0	0	0	0	0	0	0	0
X NO RATING GIVEN	26	0	0	0	1	0	0	0
JOB TOTALS	627	67	2504	150	841	87	1180	147

	Plumber		Auto Mech.		Dairy Farm.		Machinist		Nurseryworker		Admin. Asst.		Property Mgr.		Retail Mer.	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks
1.	168	33	206	43	99	20	135	19	91	17	0	0	1	0	6	1
2.	62	6	104	16	62	4	69	3	16	2	0	0	1	0	2	0
3.	12	0	8	1	21	0	145	27	9	1	0	0	0	0	1	0
4.	2	0	87	9	52	10	32	0	19	2	0	0	1	0	1	0
5.	136	28	88	16	52	9	16	0	10	1	0	0	0	0	0	0
6.	47	6	53	9	24	4	0	0	4	0	0	0	0	0	1	0
7.	68	8	116	24	61	10	129	26	31	6	5	0	0	0	0	0
8.	3	0	36	7	22	5	2	0	3	0	0	0	0	0	0	0
9.	59	5	36	0	17	0	50	3	17	3	31	3	4	0	8	1
10.	99	21	5	0	10	0	16	0	5	0	1	0	2	0	5	0
11.	0	0	1	0	2	0	0	0	0	0	0	0	0	0	3	1
12.	73	7	61	2	33	2	110	26	25	0	14	1	3	0	10	0
13.	0	0	14	1	28	1	10	0	24	4	0	0	2	0	1	0
14.	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
15.	1	0	0	0	65	15	0	0	18	2	0	0	0	0	0	0
16.	55	3	26	2	34	6	119	22	60	8	43	7	36	5	86	17
17.	11	1	29	3	32	6	44	2	55	12	41	7	57	9	104	21
18.	16	3	7	0	4	0	0	0	55	11	105	18	69	10	117	23
19.	34	4	43	1	7	0	2	0	95	14	124	24	81	16	80	15
20.	2	0	4	0	1	0	0	0	47	6	0	0	32	5	38	5
21.	17	1	52	1	1	0	0	0	30	4	28	1	41	2	23	2
22.	5	0	1	0	0	0	0	0	21	2	26	4	45	6	35	7
23.	1	0	0	0	0	0	0	0	23	4	27	4	29	2	30	6
24.	0	0	0	0	0	0	0	0	11	0	10	2	5	0	22	5
25.	11	0	51	4	12	0	73	8	8	1	22	1	5	1	6	0
26.	0	0	13	0	7	0	44	2	5	0	41	6	0	0	18	0
27.	3	0	39	1	5	0	3	0	10	1	17	0	14	3	8	1
28.	34	1	19	0	4	0	10	0	10	1	8	0	6	1	7	0
29.	19	1	52	0	9	0	87	10	30	2	37	3	8	1	7	1
30.	10	1	39	3	2	0	25	2	35	3	43	8	29	3	88	17
31.	25	2	108	18	5	0	86	8	33	1	107	19	20	0	67	2
32.	53	4	4	0	6	0	9	0	86	6	87	13	57	8	72	14
33.	8	2	9	2	0	0	0	0	19	0	73	14	45	6	20	0
34.	2	0	15	4	2	0	1	0	15	1	63	10	35	6	9	0
35.	6	0	9	1	0	0	0	0	23	3	72	16	62	9	38	6
36.	0	0	17	0	0	0	0	0	13	0	22	1	19	0	20	1
37.	0	0	51	0	14	0	8	0	24	6	44	5	84	13	53	6
38.	31	3	31	1	27	5	59	2	36	5	74	6	29	5	61	9
39.	1	0	0	0	1	0	2	0	5	1	20	3	18	1	20	1
40.	2	0	2	0	0	0	0	0	25	5	29	5	41	5	17	1
41.	0	0	0	0	6	0	6	0	15	1	10	0	5	1	12	3
42.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
X	1	0	0	0	12	1	0	0	7	1	4	0	16	0	13	0
	1077	140	1436	169	741	98	1292	160	1068	136	1228	181	902	118	1109	166

Form B: Psychological Processes	Baker		Printer		Auto Body		Carpenter		Plumber		Auto Mech.		Dairy Farm.		Machinist		Nursery-worker		Admin. Asst.		Property Mgr.		Retail Merchant	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks
1. Sensing	0	0	6	0	0	0	0	0	0	0	1	0	4	0	5	0	2	0	0	0	0	0	0	0
2. Detecting	2	0	3	0	15	1	0	0	0	0	3	0	4	0	3	0	6	0	7	0	6	0	6	0
3. Chaining or Rote Sequencing	152	30	83	17	156	35	89	13	107	27	145	34	57	3	60	5	116	23	78	10	72	11	105	21
4. Discriminating or Identifying	2	0	21	3	8	1	30	0	7	1	10	1	10	1	70	2	19	0	10	0	11	0	13	0
5. Coding	6	0	12	1	4	1	14	0	17	2	5	0	3	0	13	0	21	1	18	0	38	2	7	0
6. Classifying	3	0	9	0	2	0	0	0	1	0	4	0	3	0	0	0	11	0	17	0	5	0	13	0
7. Estimating I (discrete case)	3	0	14	0	11	0	3	0	0	0	4	0	12	0	5	0	7	0	4	0	4	0	4	0
8. Estimating II (or tracking)	2	0	22	2	5	0	0	0	0	0	1	0	6	0	17	1	6	0	0	0	7	0	2	0
9. Logical Manipulation	6	0	12	0	2	0	36	0	10	0	7	0	34	0	15	0	8	0	26	0	13	0	14	0
10. Rule Using	31	4	31	0	37	0	61	4	65	3	20	0	60	6	41	0	18	1	41	2	49	0	21	0
11. Decision Making	29	5	29	2	9	0	15	0	28	5	23	0	23	1	7	0	18	1	23	2	26	1	37	4
12. Problem Solving	12	0	6	0	1	0	2	0	9	0	27	4	29	1	6	0	8	0	9	0	8	0	7	1
X NO RATING GIVEN	2	0	2	0	0	0	0	0	7	0	0	0	5	0	8	0	10	0	17	0	11	0	21	0
JOB TOTALS	250	39	250	25	250	38	250	17	250	38	250	39	250	12	250	8	250	26	250	14	250	14	250	26

Form C: Content Domains	Baker		Printer		Auto Body		Carpenter		Plumber		Auto Mech.		Dairy Farm.		Machinist		Nursery-worker		Admin. Asst.		Property Mgr.		Retail Merchant	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks
M Technical	28	4	157	33	143	33	100	14	164	34	210	45	120	25	191	47	59	9	0	0	4	0	6	0
E Electrical	1	0	6	0	3	0	0	0	0	0	9	0	13	3	0	0	0	0	0	0	0	0	0	0
S/S Spatial/Structural	30	6	30	0	43	3	116	19	45	5	0	0	7	0	21	2	13	1	20	2	13	1	5	0
C/B Chemical & Biological	93	21	6	0	42	6	0	0	0	0	3	0	80	17	1	0	42	7	0	0	0	0	0	0
S Symbolic	37	8	39	5	13	2	34	1	28	6	19	5	17	2	3	0	54	12	195	40	162	35	173	36
P People	27	3	12	0	0	0	0	0	11	2	1	0	1	0	0	0	53	9	29	5	60	10	58	8
X NO RATING GIVEN	34	0	0	0	6	0	0	0	2	0	8	0	12	0	34	0	29	1	6	0	0	0	8	0
JOB TOTALS	250	42	250	38	250	44	250	34	250	47	250	50	250	47	250	49	250	39	250	47	250	46	250	44

Form D: Action Processes	Baker		Printer		Auto Body		Carpenter		Plumber		Auto Mech.		Dairy Farm.		Machinist		Nursery-worker		Admin. Asst.		Property Mgr.		Retail Merchant	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks
1. Input Select	17	0	3	0	1	0	0	0	0	0	24	0	0	0	1	0	3	0	6	0	5	0	8	0
2. Filter	1	0	3	0	1	0	2	0	0	0	2	0	0	0	0	0	1	0	11	1	0	0	2	0
3. Queue to Channel	3	0	11	1	2	0	23	0	8	1	5	0	1	0	2	0	3	0	22	2	13	2	19	1
4. Detect	0	0	1	0	8	2	0	0	3	0	2	0	3	0	5	0	7	0	2	0	7	0	10	0
5. Search	1	0	2	0	2	0	0	0	13	1	6	0	8	1	2	0	6	0	5	0	16	2	19	4
6. Identify	0	0	0	0	2	0	0	0	0	0	6	0	7	0	3	0	3	0	5	0	6	0	5	0
7. Code	4	0	4	0	4	1	25	0	11	2	3	0	2	0	9	0	8	0	10	0	20	0	9	0
8. Interpret	2	0	0	0	2	0	1	0	2	0	0	0	4	0	4	1	4	0	2	0	7	0	9	0
9. Categorize	0	0	5	0	0	0	0	0	0	0	3	0	0	0	0	0	7	0	8	0	2	0	2	0
10. Transmit	13	1	0	0	0	0	1	0	0	0	19	0	25	2	0	0	8	2	16	1	5	0	4	0
11. Store	3	0	4	1	2	0	0	0	1	0	1	0	1	0	0	0	14	2	10	1	18	3	3	0
12. Short-Term Memory	1	0	0	0	0	0	0	0	1	0	1	0	3	0	0	0	5	0	3	0	2	0	0	0
13. Compute	5	1	15	3	3	1	49	0	9	0	7	0	32	4	1	0	8	1	9	1	10	1	29	4
14. Count	5	0	0	0	0	0	12	0	2	0	2	0	2	0	1	0	7	0	12	2	13	2	4	1
15. Decide/Select	44	2	46	3	8	0	32	1	55	4	18	0	20	0	11	1	19	3	26	2	19	1	23	3
16. Plan	14	2	19	4	7	1	15	0	14	2	8	0	5	0	9	0	16	2	20	2	18	2	26	1
17. Test	9	1	10	0	16	1	3	0	8	2	87	12	21	3	14	2	8	1	7	0	11	1	12	1
18. Control	58	1	90	22	86	10	48	0	55	0	22	0	39	3	160	34	36	3	12	1	16	2	9	0
19. Edit	28	0	7	1	87	14	33	0	57	0	16	0	48	2	11	0	19	1	13	3	6	0	15	1
20. Adapt/Learn	1	0	4	0	0	0	1	0	0	0	2	0	10	0	1	0	1	0	1	0	1	0	3	1
21. Display	20	5	10	0	0	0	0	0	6	1	4	0	0	0	1	0	7	0	26	4	29	5	15	3
22. Purge	3	0	3	0	8	0	0	0	1	0	4	0	2	0	2	0	12	2	0	0	2	0	1	0
23. Reset	3	0	3	0	11	0	4	0	0	0	0	0	2	0	11	1	4	0	5	0	0	0	0	0
X NO RATING GIVEN	15	0	10	0	0	0	1	0	4	0	8	0	15	1	2	0	44	3	19	1	24	0	23	1
JOB TOTALS	250	13	250	35	250	30	250	1	250	13	250	12	250	16	250	38	250	20	250	21	250	21	250	21

Form E: Objects of Action	Baker		Printer		Auto Body		Carpenter		Plumber		Auto Mech.		Dairy Farm.		Machinist		Nursery-worker		Admin. Asst.		Property Mgr.		Retail Merchant	
	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks	N	Tasks
D Data	52	10	30	4	64	4	77	8	51	10	47	5	35	5	50	1	50	11	159	34	129	27	145	31
P People	20	4	25	0	0	0	0	0	10	3	0	0	66	13	0	0	42	8	34	4	70	13	44	9
T Things	178	36	193	40	186	46	172	42	188	37	201	45	148	28	200	49	157	29	45	8	42	10	58	9
X NO RATING GIVEN	0	0	2	0	0	0	1	0	1	0	2	0	1	0	0	0	1	0	12	0	9	0	4	0
JOB TOTALS	250	50	250	44	250	50	250	50	250	50	250	50	250	46	250	50	250	48	250	46	250	50	250	49

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A review of various approaches for classifying or clustering jobs, and their use in (a) describing the elements of commonality involved when people make career changes, and (b) understanding better the concepts of occupational adaptability and skill transfer.

Altman, J. W. *Transferability of vocational skills: Review of literature and research* (Info. Series No. 103), 1976.

A review of what is known about the transferability of occupational skills, describing the process or the facilitators of skill transfer.

Sjogren, D. D. *Occupationally transferable skills and characteristics: Review of literature and research* (Info. Series No. 105), 1977.

A review of what is known about the range of occupation-related skills and characteristics that could be considered transferable from one occupation to another, describing those transferable skills which are teachable in secondary and postsecondary career preparation programs.

Ashley, W. L. *Occupational information resources: A catalog of data bases and classification schemes* (Info. Series No. 104), 1977.

A quick and concise reference to the content of 55 existing occupational data bases and 24 job classification schemes. Abstracts of each data base and classification scheme include such information as: identification, investigator, location, documentation, access, design information, subject variables, occupation variables, and organization variables.

Wiant, A. A. *Transferable skills: The employer's viewpoint* (Info. Series No. 126), 1977.

A report of the views expressed in nine meetings across the country by groups of local community and business representatives concerning the types of transferable skills required and useful in their work settings and how a better understanding of transferable skills could improve training and occupational adaptability.

Miguel, R. J. *Developing skills for occupational transferability: Insights gained from selected programs* (Info. Series No. 125), 1977.

A report of clues and suggestions gained in the review of 14 existing training programs, with recommendations for practice which appear to have been successful in recognizing skill transfer and taking advantage of an individual's prior skills and experience.

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A summary report of the 1976-77 project period, presenting and discussing an array of issues encountered in the various project activities, and offering recommendations.